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A TWO-DAY SYMPOSIUM

3 - 4 AUGUST 1965

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**AIR FORCE WEAPONS LABORATORY
KIRTLAND AIR FORCE BASE
ALBUQUERQUE NEW MEXICO**

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SCIENCE, PHILOSOPHY, AND RELIGION

II

A

TWO-DAY SYMPOSIUM

3-4 August 1965

AIR FORCE WEAPONS LABORATORY

Kirtland AFB, New Mexico

FOREWORD

In August 1965 the Air Force Weapons Laboratory at Kirtland AFB, New Mexico, sponsored its second symposium on Science, Philosophy, and Religion. Prominent speakers were invited to contribute papers and discuss problems which bridge at least two of these disciplines.

From the earliest inception of the symposium, Major General John W. White, Air Force Special Weapons Center Commander, Colonel Raymond A. Gilbert, Air Force Weapons Laboratory Director, and Lt Col Willis L. Stowers, Kirtland AFB Chaplain, enthusiastically endorsed the concept. Major William Dunn, as Chairman of the symposium, made a significant contribution. The editors wish to thank the following members of the Weapons Laboratory who provided both time and energy: Lts Richard C. Brightman, Raymond J. Lawrence, Fred J. Reule, and Dr. Palmer Dyal. Finally, the editors wish to thank Mrs. Frank Parr who transcribed the talks from the tapes, not an easy task at best, and Miss Freddie Berryhill who prepared the final mats.

The transcripts of the four formal talks and the informal discussions are published essentially as they were given. The formal talks have undergone revision by the speakers and they, therefore, have been checked for content. This was not done with the proceedings of the second day. Several of the participants were concerned about publication of presentations which were spontaneous. The editors, therefore, suggest that the reader bear these comments in mind and qualify any literal interpretation.

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INTRODUCTION

CHAPLAIN STOWERS

For those of you who are with us for the first time, welcome; and for those of you who shared with us last year, we're glad you are back. From the very inception of this Symposium, support, enthusiasm, assistance, and cooperation have been accorded by the staff of General White, because he himself has been one of the enthusiasts. Also, Col Gilbert, the Director of the Laboratory, his staff and the committee have done practically all of the foot-work in preparing for this Symposium. We hope that through this Symposium you will find that there is a partnership, that there is a correlation, between science and religion which must come about if we today are to be complete persons. We must learn not only how to circumnavigate Mars, probe the power of laser and other objects of advanced science, but at the same time, we must learn not only how to live, but how to live with power and control.

We now take great pleasure in presenting to this audience for our 1965 Symposium, the Commander of the Air Force Special Weapons Center, General White.

GENERAL WHITE

Thank you, Chaplain Stowers. Good morning ladies and gentlemen. It is again my pleasure and privilege to welcome our very distinguished participants in this year's Symposium and you ladies and gentlemen who have come to hear the discussions which will take place today and tomorrow. Last year our Symposium carried the title, "Science, Philosophy, and Religion." I note that the planners for this year's Symposium have substituted the word ethics for religion. While I haven't inquired into their reasons for doing this I don't propose to quarrel with them about it. But, for the purpose of my introductory remarks, I am going to stick with the word religion because, as I understand it, philosophy encompasses the field of ethics, whereas religion embodies other important considerations not covered by science, philosophy, or ethics. I note with pleasure that some of our speakers here this morning have taken the liberty of including religion in the title of their discussions.

If there is a common denominator of the three subjects, science, philosophy and religion, I believe it would be knowledge and truth. All three have as their basic objective the search for knowledge and truth. Science is a search for the general laws which relate to the nature of the universe and to the nature of man. Philosophy searches for the facts and principles of the reality of human nature, logic, ethics, aesthetics, metaphysics, and the theory of knowledge itself. Religion searches for the knowledge and truth of man's relationship to God and of man's spiritual and moral well being. It is, therefore, of considerable importance to have gathered together in a single symposium a group such as Father Henle, Prof Margenau, Prof Nagel, Prof Rabi, Dr. Sarkar, Prof Lehmann and Father Clarke. All of these gentlemen are eminently qualified to discuss with us the knowledge and truths as understood and believed by themselves with respect to science, philosophy, and ethics. As with last year's Symposium we plan to record the proceedings and, in due time, publish them for those who desire copies. Again, it is a distinct pleasure to welcome you to Kirtland Air Force Base. I regret that my schedule is not going to permit me to be with you for the morning session but I hope I will be able to join you later today and tomorrow. Colonel Gilbert, you're next on the program.

COLONEL GILBERT

Thank you, General White. I would like to add my welcome to our distinguished guest participants and to each one of you who are going to be with us for the next couple of days. One of the reasons that we in the Weapons Lab wanted to sponsor for a second time, a Symposium in this general area was that sometimes, being principally a technical organization, we get a little bit too tied up with science. We also get a little too impressed, I think, with the things science can do and we sometimes forget some of the things science cannot do. We think that science is important, not only in the work that we're doing, but we also feel, or at least I feel, that a well-educated man today must have an understanding of science and technology and its impact on our entire social fabric. Science is important but it takes science and technology plus the humanities to make a well-rounded, well-educated individual.

We need to look though at some of the other sides of the picture. For example, one of the things that science and technology does not give us is a sense of values. There is no way to describe in a technical sense what beauty is or what is right or wrong. We find that in a lot of our everyday dealings, in

the work that we do, it isn't all science and technology, but a lot of it has to do with ethical problems. There is always the question of how to treat other individuals, organizations, and agencies. The question of trying to resolve what constitutes conflict of interest, for example, is a serious problem which people are grappling with at all levels of the Federal Government. The question of the relations with contractors, how do you deal fairly with all contractors and still, at the same time, get a reasonable product for the government? These are not questions which science and technology alone can solve. Another reason for a Symposium like this is to try to provide a little perspective. I am continually impressed by the way we throw around certain words or phrases. For example, at the time of the first atom bomb, we talked in terms of kilotons of yield. A kiloton, is a thousand tons equivalent of high explosives. And later with the thermonuclear weapons we started talking about megatons. Now we attribute to the Russians a hundred megaton weapon and yet, I think, that very few of us really appreciate what a hundred megatons really means. Oh, we can make calculations as to what effect this weapon might have at various distances but I do not think we really have an appreciation of the impact of such a weapon, on a nation, state or city. And, I think we sometimes tend to forget the people part of the science and technology and the impact of what we are doing on people. Perhaps this seminar will help us direct our vision to some of the consequences of the work we are doing.

I am also reminded of some of the discussions the press has prompted regarding an apparent conflict between the people in the Office of the Secretary of Defense who use computer analysis to determine the direction the Department of Defense programs will take and the people who value the so-called military judgment. Now I find, in talking with senior people both in the Office of the Secretary of Defense and in the services, that this is not a real conflict. Nevertheless, some segments of the press have tried to build it up; military judgment of senior, experienced people on one side and McNamara and his computers on the other side. I think most people realize that you have to have both. There are some problems that computers can solve very well and that if military judgment flaunts the basic laws of physics, military judgment is most likely going to be wrong. On the other hand, it is extremely difficult to program on a computer what actions are going to be taken in various countries throughout the world; what government is going to be overthrown next and why; and what the consequences will be. These matters are matters for judgment, they are not matters that can be solved in a technical way with a computer program.

In the May 1965 issue of Fortune Magazine, Bush, one of the grand old men of science, wrote an article that I would like to suggest that you read. It is entitled, "Science Pauses," and in some respects this article could well set the tone for what we are going to do here. Dr. Bush appreciates very well, at least from my point of view, the role that science has to play in modern society.

I would now like to introduce our moderator for the next two days. He is Major William Dunn, who is with the Directorate of Science and Technology in Hq USAF. Bill was born in 1930 and he seems young when I look at my birth date. To show that we are a well integrated organization, he graduated from the Naval Academy in 1952. He took his Masters Degree in 1957 from the AFIT, I believe at that time Dr. Lehmann was Chairman of the Physics Department there, and then he was sent down to Texas A&M, a regular civilian university, where he finished his PhD in Physics in 1963, working in molecular spectroscopy. Bill has been heavily involved in the nuclear weapons effects research and test programs that were proposed by the Air Force for work under the Defense Atomic Support Agency. He is well aware of the programs we have here at the Laboratory and of the people in the Laboratory who have been concerned with our efforts. He understands physics well; he understands nuclear weapons and some of the awesome effects that can be produced by these devices, and, Bill has a broad enough background that he understands the other side of the coin, that is, some of the ethical, the philosophical, and the religious questions. So, it is with a great deal of pleasure, that I introduce our own Major Bill Dunn.

MAJOR DUNN

Thank you Col Gilbert. It is a real privilege to participate in the second Weapons Laboratory Symposium. I think the continued interest at all levels of the Center and of the Laboratory in this type of endeavor is refreshing indeed when this age of specialization seems to push all of us into military and scientific stereotypes that don't really seem to have any real concern outside of our own immediate fields of interest. To demonstrate how the learning of man applies to the purposes of life is not only intellectually stimulating but I believe of necessary and real concern to each of us. Because, ultimately in our own lives we must resolve this question for ourselves.

I have several procedural announcements which I would like to make. There will be a period after each talk today when we will entertain questions from the floor. The questions which cannot be handled at that time should be written down on the cards that will be provided. These written questions will then provide the basis for our panel discussions on the second morning. Then, during the second afternoon we will reopen the panel to discussion of questions from the floor. Since the proceedings are being taped for publication, we ask that when you present a question and are recognized that you wait until the microphone is brought to you so that we can hear all the question. We also ask that you identify yourself and your affiliation. I want to add one last note in line with what General White mentioned. Some of our speakers have already indicated that the word religion was explicit in their minds in the title of the conference and we were interested to note that it had been changed when we arrived. However, it is linked with ethics, and it even could be considered under philosophy. However, we would like to include in our mental title of the conference the word religion.

FATHER HENLE'S TALK

MAJOR DUNN

I would like to introduce our first speaker who is Father Robert Henle, a Roman Catholic Priest in the Jesuit Order. He has a PhD from the University of Toronto and is author of numerous publications including, Method in Metaphysics. He is a past Dean of the Graduate School and is now Research Administrator and Academic Vice President of St Louis University. His talk, "A Search for Personal Commitment," should provide a fitting opening for our Symposium.

FATHER HENLE

Thank you, Major Dunn. First let me say that I'm very happy to be here with you, that I'm honored to find myself in such distinguished company and extremely interested in being able to talk to you about matters of such great importance. With all this talk about religion, however, I hope that the fact that my talk is the only one that does not have religion in the title will not lead you to think that I have any predjudice in this matter.

I am going to talk about what I have called a personal commitment. I'm going to attempt to avoid using much technical terminology either of a theological or a philosophical or even a humanistic type in order to keep this in a common matrix of ordinary conversation and of ordinary human experience. When I talk here of a personal commitment, I'm talking about an individual's involvement in, acceptance of, or dedication to something which serves for him as being of primary importance in life. It involves truths, principles, facts, or values all wrapped up into an integrated human experience and human reaction. The search for this kind of commitment, the commitment which will involve the total personality of the individual is common, I think, to the whole of humanity. I don't mean to say that every man or that any man at every turn in his life is involved in a search for some ultimate sort of personal commitment. But, it is characteristic of the human race that we do look for something of this sort and we try to construct for ourselves some sort of commitment. From the theological standpoint this is a universal search for God. From a philosophical standpoint you could say it's a universal search for a meaning in life in general and particularly in one's individual life. From a psychological standpoint we could say it's a search for completeness and integrity and the fulfillment of human nature, of man's desires, and of man's longings. From an epistemological standpoint we could call it the ancient search for wisdom as opposed to a search for knowledge.

A personal commitment of this kind is personal because it involves each individual in the very roots of his being of his experience of himself and of what he is. I think, that Cardinal Newman's distinction between notional and real assent would serve us well here in attempting to distinguish the kind of knowledge and the kind of value acceptance that constitutes a real personal commitment. From ordinary knowledge, particularly certain kinds of ordinary knowledge, this distinction between notional and real assent can be described somewhat roughly as follows; there are a lot of abstract propositions, particularly in the formal things that we learn in school and in various other disciplines, to which we assent. We have a conceptual understanding of what they mean, a kind of abstract understanding; but we do not accept them with any personal adherence, nor with any deep realization of what they mean. A crude example of this would be what we read in our newspaper. For the most part we have notional assent for the horrible things we read in the daily press. Such as, 20,000 Chinese starve to death, 76 people burn to death in an airplane, and we turn the next page and reach for the next piece of toast and go on. Do we know what it means that 76 people were burned to death in an airplane? Certainly we understand these words; we know what they mean. We know what it means to die of hunger, sure. But, what affect does it have on us as we read it? We accept it, we know it, we understand it, a purely notional abstract kind of acceptance of this fact and these propositions and this meaning. A totally different kind of thing from what it would be if it were our own child, who is dying of starvation, or if it were some of our loved ones who burned to death on a plane. Then we would have a personal realization, this would become part of our personal experience.

To make knowledge or truth, whatever we accept, whether in philosophy or in science, in psychology or religion, this kind of personal commitment means that we have to have a personal realization of it. It has got to come home to us; we've got to feel it as well as know it; and we have to understand it and realize it as well as accept it simply as a fact or value. The other point is that the only way this can be realized and can be made part of me as a person is that it be rooted ultimately in my own experience. I cannot take abstract knowledge and abstract truth and turn it into a personal commitment unless it is related somehow to a basis within my own experience. Now this is not a simple matter and I am not pretending either to define experience or indicate the kinds of relationships that such active knowledge must have to it; but, I defend a general proposition that unless a piece of knowledge or acceptance of value can somehow be, however indirectly, related back to each individual's personal experience, it can never become part of the knowledge to which he gives what Cardinal Newman calls real assent. It can never become part of the motivation of a personal commitment; it can never become part of one's individual personal

knowledge. This is the kind of thing we have to have to achieve wisdom, to achieve a personal commitment. The search for personal commitment, of this kind, I believe, goes on in the life of every man. When I say search, I'm talking of different situations. In the case of some adults it is a search that begins with a collapse or a total lack of a personal commitment, a sudden awareness of emptiness in ones life, of having a lot of material things and a lot of knowledge but no purpose or direction to life, no overarching view which gives a person guidance in making the moral decisions, in carrying on the human enterprizes, in which we all find ourselves. Some kind of commitment which can, in turn, dictate to us either our religious actions and positions, or our ethical actions, or our moral actions. Then, the search can begin. Or, in the case of anyone who has a personal commitment or a quasi or pseudo-personal commitment that has come from family, education, and tradition in our culture. As a mature adult, and particularly as an educated adult, such a person at some point in life finds it necessary to make it a more personal matter and relate it to a more personal experience and a more personal acceptance. I am saying that this personal commitment cannot exist in an educated individual within our culture, perhaps in no one, simply by means of convention, indoctrination, tradition, or social pressure. This is part of the great problem in this age. The search for personal commitment in our culture really is a search which becomes incumbent upon every person as he matures, as he comes to be an adult intellectually, morally, and personally, regardless of what he has brought to his adulthood.

I'm not saying that we should discard everything that we have from tradition, family, or from our early education, but that we have to reexamine it at some point in our adult life, or maybe for a long period in our adult life, to make it truly ours within this culture. I would like to point to some facts, some situations which exist within our culture which makes this so important for us in the present situation. Anthropologists have pointed out that there is a great deal of realism, in a humanistic sense and not a philosophical sense, of earthiness, of genuiness, in peasant culture. There they have very little formal education but a lot of contact with nature, with the earth, with earthy emotions. These people live close to nature and are not surrounded by a lot of social and physical situations that isolate them and protect their privacy. There is reality in this limited culture to be sure and there is a kind of a personal depth that we sometimes do not find in the sophisticated, cosmopolitan product of an urban civilization at a high level of intellectual development. I think that there is something within our culture that makes this difficult. In our educational system we attempt to build into each individual an overwhelming amount of abstract knowledge, a vast system of symbolized concepts of the most erudite kind; not things like an apple, which we can show a child.

With these enormous systems we attempt to recapitulate, in a way, the cultural history of the West. At least, we do this with all the scientific, logical, and humanistic discoveries that have been made from the times of the Egyptians and we cram this into a few years of a man's life. So, our education is very formal, its highly abstract, and its highly sophisticated. It's loaded! And, one of the basic problems is that the abstract knowledge we give an individual is so vast compared with the amount of his personal experience that you create a whole world of notional assent in every modern man's mind. And, its very difficult for him to assimilate this batch of knowledge, this understanding of theoretical systems, this vast amount of fact, which he just barely grasps.

We were just listening to Col Gilbert talk about the enormous amounts of explosive power which you grasp by an abstract calculation but you cannot grasp by any reduction to something which you can really experience. I can experience the explosion of a firecracker. I can relate things back to this; but, the things that we're talking about cannot be related. The average man is lost when he hears about the distances which we're now spanning with space probes. In a sense, what it's doing to space is making it plebeian. We don't really appreciate it any more; because, we have such vast conceptual abstractions with regard to it. This makes it very difficult in any man's education to find those pieces of knowledge, that insight, that understanding, that realization which must be brought back somehow to the reality of individual experience so that it can become part of his personality. The modern product of modern education somehow can be thought of as the kind of personality with knowledge attached to it. The person is under control of it, but attached to it, not integrated into it. The vast amount of formal education which we obtain is one of the reasons why it becomes very difficult for any individual in modern society to incorporate within his personal commitment what he has actually learned, and to bring it to bear upon his personal commitment. And, because we have overwhelmed our people with this enormous amount of knowledge, it is very difficult for any individual to determine what parts of his knowledge are relevant. Where can he leave the notional? What, of all this, is relevant to me as a person in making my personal commitment to values and value systems? Where is my guide? The philosophers certainly aren't doing much guiding. The scientists aren't doing much guiding. Where is the guide inside the world of learning that's going to do this? If we select randomly, or grab for pieces, we might leave the most fundamental piece of knowledge, the piece that has the most fundamental importance for me as a human person, up in the notional area and never bring it to bear. We know, to a large extent, what pieces of our knowledge to bring to bear on a technical problem. But, what pieces of our notional knowledge should be turned into real assets so that I can be a fully integrated

human being is a very difficult problem. And, it's obvious, that we can't possibly turn every bit of our notionally accepted knowledge into a real assent. We can't do that. If Descartes had achieved his goal, or if modern science could achieve its goal, and we could live for a thousand years, maybe we could do more of this. But, actually in the present state of mankind, we can't do it. This is one of the reasons that makes this problem extremely difficult in face of modern culture.

The other thing, of course, is that we have grown into a sophisticated culture which we've become accustomed to describing as a culture of pluralism. In fact, it's part of the American boast that we're a pluralistic society in many different ways, racially, nationally, religiously, and politically. We have right-wingers and left-wingers and in-betweeners and people that don't know what the difference is between the right and left wing. And, we have atheists, orthodox Jews and pious Catholics and all the rest in our culture. We're very proud of our culture but it creates a problem for individuals. This is vastly different from a culture in which there is a predominate kind of acceptance and underlying set of moral values and religious beliefs, which everybody accepts and which simply are there as much as the atmosphere, or the flag, and everybody's got it and you take it into every part of society and you appeal to it no matter where you are. This latter type of culture provides a solution to the problem because it gives everybody the backup of a social commitment, which, because we are part of a society, can through social intercourse become a personal commitment. And, of course, because all of these cultures, all of these religions, which have been developed by human beings, have a good deal of realism in them and a good deal that has come out of human experience, it can serve, whatever mixture of other things it may have, as a rough guide for people to live by. But, you throw people into a society, such as ours, where you do not have this kind of social background, where if a man is going to be a Catholic or an Atheist or a Nazi, he's got to stand on his own feet and make up his own mind, then you have problems. We have a society which has increased the need for doing it personally while it has simultaneously increased the difficulty of doing it personally.

Well, I see no real solution for an educated person in this world in which we're living except that he has to make certain choices, with regard to the knowledge that exists in the world, and he has certain fundamental options. To me one of the basic approaches to the question of, what knowledge is relevant to the situation, and how I can use that knowledge with reference to my own personal commitment in my living, immediately points to the importance for the individual person of what many of us would call epistemology. So, I am taking a position that I can see, in the pattern that I've just described, one piece of human knowledge or

alleged human knowledge, that is relevant to the individual choice. This is in regard to the other pieces of knowledge which constitute my personal commitment and how I arrived at it. Now let me illustrate this. I'm going to talk about two basic options within epistemology. One is an ancient option which reappears in every generation of philosophers and intellectuals in different forms, and that has been reformulated even in non-western cultures. The fundamental option is between a philosophical realism and any kind of a thing which isn't a philosophical realism. Many people who lie on the other side of realism feel that they don't want to be bunched with a lot of other people over there but, it seems to me, this is the point where a line can be drawn. You can also draw other lines. But, here is a fundamental option which has to be made. Now, I know that there are some philosophers who argue that it makes no difference. When the geologist climbs a mountain, if he's a Kantian and doesn't believe that the mountain is there, but it is a product of complex machinery within himself, or if he's an old line Thomist who thinks the mountain's mighty real indeed and that its there without him, this makes no difference in the report he makes to the National Science Foundation when he goes home, or as to what rocks he found on the mountain. This is true enough. All this proves is that geology isn't that deeply written into human life. But this is an option, I think, that has to be faced and which we all face whether we're philosophers or not; as a matter of fact, we all take an option here. If we're not philosophers we make it in a very realistic way but in a very sloppy way. If we're philosophers we do it in a very delicate way but a very unreal way. And, I don't know which is the better way. As a matter of fact, it is much better if we make options, that are this fundamental, by understanding what we're doing, rather than making them by accident or implication. I would say, that, for most people, this option is made by accident and implication.

Now, for the other option, and I'm probably inaccurate in talking about this as being a real option because its more of a spectrum of possible options. This other one had to do with what position you're going to take with regard to the deployment of human intelligence into different forms of knowledge. The basic words, I guess, in epistemology, are words like intelligence, reasoning, knowledge, and truth; in a sense all these words correlate according to whatever philosophical position you're going to take. If you maintain that there is no possibility of any kind of certitude about things, you really are saying that truth is relative or non-existent, and you are really saying that all knowledge is relative. So, this is a kind of a mobile of words and when you blow on it all the words assume a new position; this is what happens when you take these words into different philosophical contents. Now, you can take different positions which will be a different kind of motion of air against this mobile. Some philosophers and philosophers of

science take the position that the only kind of valid human knowledge that we've got - and that's not too valid - is that which we achieve by the scientific method. So, you ask, "What do you mean by scientific method?" Now here again, you've got some options to make. If you take a very narrow view, scientific method turns out to be the fundamental methods of physics, chemistry and biology, and those which have been transferred by analogy and readaptation into other areas of knowledge. I'm doing this in a very rough way because the definition of scientific method is a very difficult matter. We have some notion of what we mean if we start with the disciplines in which we recognize that scientific method exists. If you say that's the only kind of real knowledge, then you have to say that philosophy has no independent validity. Consequently, if the philosophical positions are going to be dictated by the current positions in physics, biology, and so on, you get one set of relevant knowledge for making up your personal commitment. If, however, you take a pluralistic view of the world of knowledge, and say that this is not the whole truth of the matter and that there are differences which have differentiated themselves in the course of human culture, which can be designated as having a certain kind of method which is proper to them, and that these sciences and disciplines can do certain things, and the things they can do are determined by the kind of technique and methodology and the internal constructual scheme that has been developed for them, then you're in a much more free-wheeling situation; and, in fact, a much more difficult one.

Once you've decided that there is only one line of human, cultural development in which you can expect to find knowledge, wisdom, and truth, and this line becomes the salvation of a personal commitment, you have found a relatively easy way out. But, you might say, that's only one line, there are alternatives: philosophy also has an ancient tradition of independent methodology and it does have things to contribute which depend on its methodology which physics and chemistry can't contribute; and also there is a whole humanistic tradition which is less precise, but nonetheless is deeply relevant to human life. The latter applies human intelligence to human life in a different kind of approach, however you want to describe it. And, no two humanists will describe it in the same way. But, looking at it from the outside it appears to be very different from the way an empirical psychologist begins to analyze and to work out experimental and operational definitions. Think about some of the great dramatic studies of human character types, then read personality psychology, see what a vastly different approach this is. Well, if you begin by not limiting yourself to one approach, then you've got a much more difficult task of determining what is really relevant for your personal commitment as a human being? Because, you've got a wide range of disciplines to choose from.

Let me put this another way. I think most people today would be afraid to put themselves in a position of saying, that we should make knowledge decisions independently of intelligence. I can see some cultures in which this might be the right thing to say, and which would be accepted; but in our culture nobody is going to put himself against intelligence. So that another way of stating the option, that I've just described, is to talk about the kind of definition of intelligence you are going to use. Perhaps definition is not the correct word. But, you must point to some of these things when you're dealing with ultimate things in experience which are not constructed but which are given. You can't really state a definition without distorting it. You have to say what you mean, and then point to it and put people through the experience of it. It's like the famous story from the French Academy where a group of philosophers began to discuss love, one young man was very vehement in talking about the philosophy of love, and some of the older ones looked at him and said, what do you know about love, have you ever been in love? He said no, but I've studied it. And they said, oh, you don't know anything about it, you don't know what love is. So he thought about it a minute and got up and went out. Five years later he came back. He said, I'm ready to discuss it now; because, I've been in love and I know what it is. Well, there is a great deal of truth to this. And, therefore, with regard to intelligence, one of the difficulties the philosopher and the psychologist is faced with is the question, that, as soon as you begin to define intelligence you tend to place some kind of a preestablished form on it and limit it. So, one way of describing intelligence would be by describing the efforts of intelligence which you're ready to accept as belonging within its range. I think that in many of the philosophers of science and education you get this mobile shifting. You ask, what is human intelligence? Human intelligence is that power we use by a scientific method. And, so, the scientific method then becomes a definition, a primary definition of what intelligence is.

In John Dewey, for example, I think both of these get shifted, because of his effort to broaden scientific method and yet identify it basically with the method of science and at the same time use it as a definition of intelligence. In John Dewey intelligence gets squeezed down, scientific method gets broadened and the whole mobile becomes a little fluid. But this is the kind of thing that happens if we are attempting to lay the problem out and look at it. Therefore, I would say that for an educated man today, one of the fundamental problems that he's got to solve, in order to put himself in the way, first of having a really truly personal commitment and secondly of having an intellectual commitment (not that it's all intellectual because my personality is not just a pure piece of intelligence, but that it's intellectually acceptable and that it's intellectually sound) is that he's got to make up his mind on certain epistemological issues.

And, therefore, I would say that within the whole of modern culture, one of the things to which everybody, in some fashion, is bound to address himself is this question of the validities and the varieties of human knowledge, their limitations and their possibilities, taken in a total context and in an effort to define human intelligence. Now, I've laid this out as a problem, I think we can discuss this as we have more time. I've taken the approach of attempting to point out what seemed to me to be some of the basic problems when you try to answer the question that's in our Symposium program. The program is "To demonstrate coherent interrelations among science, philosophy and ethics, or how the learning of man applies to the purposes of life."

Now, I've tried to point up what I've considered to be some of the basic problems in answering this particular question, and you've noticed the problems that I've pointed up really are critical to the statement of our program. For, in order to demonstrate coherent interrelations among science, philosophy and ethics you must face a fundamental epistemological problem. What kinds of knowledge? Is philosophy a kind of conclusion from science? Is it speculation that is eventually eliminated by the progress of real knowledge, which is science? Is it a kind of vague charting of the future course of science? What about ethics? What is ethics? Is ethics a psychological discipline? Is it a philosophical discipline? Do we have to go to our emotions for ethics? The epistemological problem is basic to any kind of interrelationship here, and it is also basic to bringing to bear upon the purposes of human life any knowledge; because, knowledge comes to bear upon human life only through us. So, what knowledge and how much, and in what way we use knowledge at this level of personal commitment where our ethical decisions are made, where our religious decisions are made, and where our primary human loyalties are made, are not in the area of notional assent. I'll just give you one experiment related to this problem. I feel very strongly about this; because, I have tried to teach philosophy for years to people who were only 18, 19, 20 years old, when I myself felt that I was barely beginning to get enough experience to have some notion of what some of the philosophers were talking about. Directly after the first World War, at St Louis University, spontaneously all of our ethics professors said that they had never had such fun teaching ethics in all their academic careers. And the reason was that they had veterans coming back, who had been through human situations and had been forced at an early age to make very mature decisions and very mature judgments about other people, and were put in situations where they couldn't just laugh it off or regard it as something to think about later. Well, they had to make decisions on which lives, character, and sanity depended; so, when they came back and went into a classroom and began talking about ethical problems it was not a lot of notional nonsense as it is to the

average college student who has none of this experience. These people had experience which made this real to them. They could really get down and talk about the implications of these experiences.

MAJOR DUNN - We're ready to entertain questions from the floor.

FATHER CLARKE - I would like to take this occasion to point out some of the problems we should be handling during the next two days that come out of Father Henle's talk. Once you speak, as he did, of the personal commitment, it seems to me that you're speaking of the whole. When I use the term person that's a term referring to the whole self, whereas if I use the term scientist it's just part of my activity. Hence, I would like to ask him, and to challenge all of us here, that once you're trying to get personal wisdom, isn't it necessary to have some kind of vision of the whole, some kind of single ultimate goal in order to set up a hierarchy or system of relations between these different types of knowledge. Therefore, would Father Henle accept that the problem he would have to answer must be set to all the parts in relation to the whole. And how does one determine that whole?

FATHER HENLE - Are you using "whole" in two different senses, the "whole" person and the "whole" of knowledge of the world?

FATHER CLARKE - A vision of the whole purpose of the universe.

FATHER HENLE - I trust your version of the whole is to put everything into a relationship. Well, then naturally this is true, but if you're in a search period you can't make a leap to a whole and then come back and put everything in order. When you're in a search for something you begin to search around for pieces through which you might get to a whole. This is why I think it is so important that you at least make options about the kinds of knowledge. For instance, the knowledge of a typewriter, I would rule rather quickly in a search as not revealing anything, that is, as giving me any footage to move further. If a man makes up his mind that real intelligence, is limited to four disciplines, and that other disciplines are simply either pseudo-disciplines or dependent upon these basic disciplines, then where does he move within this frame? To put it a little bit more concretely, a man comes into a modern university and asks, I want to learn about man, or he asks, where can I learn about man? And you say, well, what do you want to know about man? And, he answers, I just want to learn about man. This is a primitive question that you have to answer before you get cultural development. Well, you might say that experimental psychologists say a lot about man and you can study with them.

And, there is an anatomy department, and they say a lot about man. Also, the physiology department is doing a lot of work on the emotional state, and the biochemists, they're studying the metabolic changes that are used in emotional states too, and there's a funny group up in the attic called the philosophy department, and they know something about man. Where do you go to find out about man? Well, let's use this search against the spectrum of possible disciplines. Certainly the view of the whole requires some basic view of man and let's call it a kind of correlating or a guiding view of man. Now, where do you go to get that? Who gives you that? Do you simply take everything everybody has said and add it up? Now, if you do that you're going to find yourself with some very funny propositions. It will rank scientifically the way a rag, a bone, a hank of hair, rank as the description of a woman. You simply can't do that. Now where can you break through and get a norm? This is the question. I think that if you're in the search period, you haven't got the vision of the whole that's going to enable you to say that. I'm going to have to make an option at this point in regard to what I think about these things. Because, when you take a very extreme, of what I would call a very narrow view of scientific method, about 50% of the disciplines I've just mentioned would be ruled out. They haven't got anything real to say about man. You can go to the anatomist and ask for the scientific approach, you can go to the biochemist and ask for a scientific approach, you could ask the philosophers for the same, but you cannot go to the humanists. So, I would say that if you had a view of the whole then you could come back and do it. But, I think the problem that faces modern man in his search for personal commitment is that he doesn't start out with any sure view of the whole, he's got to work toward this. That's why the epistemological option, seems to me to be of such crucial importance here.

FLOOR - May I state that the difficulty in most people in arriving at a personal commitment, if we're talking about intellectuals, is the responsibility and the fault of our education system. It's much easier for a teacher to avoid letting the student think about the facts. The student doesn't have time to think about the basic things. A man is forced to accumulate a lot of knowledge and not allowed to think, and when he does think he gets behind in the class and before long he's flunked out. What happens is that it takes many years after he graduates before he begins to realize that all things that were taught to him really aren't so. And, that a lot of it just doesn't hold true. This, I think, is what makes arriving at a personal commitment so difficult; because, arriving at a personal commitment as you're discussing, requires the individual to really think, to really analyze. But, he's not been allowed to think from the beginning, he's been schooled and trained and beat down to the point where he is not permitted to do this. Schwitzer says, "We've given up the art of thinking, we

don't think anymore," And, until a man has been doing research and begins to realize that there is more to it than just one, two, three and four, he's terribly naive. So, I would like you to comment on that.

FATHER HENLE - The problem of getting far enough into a discipline is very pressing on both graduate and undergraduate students. What you say is true. Even within their own discipline they do not have time to think about it or time to go through and make it real personal. I remember a former Dean of the Graduate School at Princeton, Taylor, a chemist. Once, in a discussion he was asked, what's the best way to teach chemistry? He said, really, if we had enough time, the best way would be to give each kid a lot of chemicals and tell him to go off and play, and wait for him to come back with some questions and answers. But, of course, he'd be 60 years old before he finished freshman chemistry. The problem is, and I suppose I shouldn't be the one to say this, that the most dogmatic thing taught in undergraduate schools in the United States, is the science courses. There is not an adequate exposition as to how you come to these things. You get the students in their freshman year and you teach them the most complex theories and then somehow you pretend that you're establishing it by taking them into a laboratory and giving them a preconceived little sample. The sample fits perfectly because that's the way you build it. It's frightening. The person most hurt by this is a BS in chemistry. This fellow really thinks it's all worked out this way. It's perfect. You have to get him in the graduate school, kick him around, talk to him, beat on him, and then he begins to wonder how do they establish these things, and what is the relation of methodology to the kind of theories we've got. We should do the latter in the specialties and do it across the board. I once said, and I hope nobody reports this back to our science department, because I'm always getting in trouble with our departments, that practically every PhD I know of that's come out of St Louis University in science is a Doctor of Science and not a Doctor of Philosophy because he doesn't even know his own disciplines. He can go out to Monsanto and get a job and test soap flakes adequately, but he isn't doing what you're talking about, this thinking business.

PROFESSOR RABI'S TALK*

MAJOR DUNN - Our next speaker is Dr. I. I. Rabi, a most distinguished physicist, who received the 1944 Nobel Prize in Physics for his study of the magnetic properties of the atomic nuclei. He is a University Professor at Columbia University, a scientific advisor to the President, to the United Nations, to NATO, to the Atomic Energy Commission and to the Atomic International Commission. He is also a past president of the American Physical Society. His publications include, "My Life and Times as a Physicist," as well as numerous scientific contributions. It is a real honor to present to you Dr. I. I. Rabi.

DR. RABI - I'm delighted to be here and I can already see that we're going to have a good time at this meeting. I stand before you as the example of what Father Henle describes as a fourth-year Chemist, and one who has been thoroughly indoctrinated. My undergraduate degree is a Bachelor of Chemistry from Cornell, and I'm an orphan, like the DeSoto automobile, because this degree has been discontinued. I was very impressed with Father Henle's talk. He certainly spoke like a true Dean, giving equal weight to every discipline. He suggested that you have a problem and that there are ways out of it. Being a true Dean he couldn't tell you which one. I, on the other hand, am an honest-to-goodness experimental physicist. So, I, in a certain sense, have been there. I've never been a Dean, so I don't have to be impartial. Therefore, I will present what almost necessarily has to be a partial point of view, at least in the opinion of many, but, it will be the thing.

I'm very much impressed that we're even having this meeting under the auspices of the Air Force. I'm shown again what a remarkable and dynamic organization the Air Force is. How revolutionary in nature and concept it is. I think in the ordinary military organization, if questions like how one may "demonstrate coherent interrelations among science, philosophy, ethics" or how "learning applies to the purposes of life" arose, the military hierarchy would send somebody down to indoctrinate the group. There, there is but one point of view - the proper point of view.

*Ed. Note. Due to the press of other matters, Dr. Rabi was unable to review this transcript prior to publication. The editors assume responsibility for any errors incurred in translating the spoken word to the printed page.

And you would get it; not the kind of confusion you're going to get from us. We are here as rank outsiders to talk about these questions and when we go away, still keeping our original opinion, we'll leave you confused.

I think this subject is particularly important, and I'm glad to be here, in this Laboratory which tests weapons effects. I happen to be one of the few people who was fortunate enough to be present at the first atomic bomb test at Alamogordo. I saw it happen and I had the immediate experience which Father Henle has described. There is nothing like immediate experience; because, it is not knowledge but it is something which becomes part of our viscera, our intellectual, mental viscera, in the sense that our decisions are made within as a commitment. In a certain sense, this is the educational problem that we have, this feeling of actually being there, not as a piece of information but as one of the elements which enter into our decisions, both consciously and unconsciously.

I very much appreciate the concern which people have working in the field of nuclear weapons effects. Col Gilbert expressed it to us today in the talk we had before the meeting. I think it's a concern of each one of us.

There is one further problem which we have to meet; because, this is not just an individual concern. Somehow in our system of morals and ethics, we lack a feeling of common concern. When something is done nationally, in which we are all involved, and for which we pay taxes, there ought to be some kind of conscious yardstick of national or mass morality rising above the individual morality. The latter often finds itself powerless. There are many people, as you know, who discussed the dropping of the first bomb on Hiroshima. They considered it an immoral act. But, you certainly cannot say that it was an immoral act on the part of the group that dropped the bomb. And, you cannot say it was an immoral act on the part of the people who developed the bomb. I, myself, don't believe it was an immoral act; but how is this morality to be judged? What are the norms? And, when we get to a certain point, when the numbers are larger, or when groups are organized under a national flag, or a state flag, or whatever, one could guess the normal moral norms. I think with the current advance of science where tremendous projects require the combined efforts of thousands and millions of people, somehow a shared responsibility and a shared moral meaning must come into existence. I have talked with various people, philosophers, religionists, and I have preached to them about this, but so far I've seen very little in the way

of books which would illuminate the problem. These remarks were stimulated by both the setting in which we are and the remarks of Father Henle who stressed the personal commitment. I do not wish to weaken these arguments; but, as members of a tightly knit community, we also have a need for a mass commitment.

Now, let me come to my topic. The word religion also enters into the title of my talk. I don't want to deceive anybody with the idea that I think that I know anything about religion. All I know about religion is, as Mr. Atchinson once said, "What I learned I got at my mother's knee and other low joints." I think the great mathematician Hilbert was once asked - what is the relation between pure mathematics and applied mathematics? And he said - that's very simple. There's no relation whatsoever. The same very eminent man, perhaps the greatest mathematician in this century, told the following story after the First World War. In 1917 in the midst of the blockade, he had an invitation from the rector of a university asking him to come to his house at seven in the evening. Now he was tremendously excited about this invitation and tried to figure out what it meant. And after long cogitation, he decided that the rector had somehow or other gotten into the country and had acquired a pig and they were really going to have a feast. When he arrived at the rector's home, there were other members of the distinguished faculty and he was certain that his surmise was correct. Precisely at seven, the rector came in and said - "Gentlemen, I've called you together to say that I have the honor of announcing to you the beginning of unrestricted submarine warfare." At this point Hilbert said to himself, "I then realized that I was living among madmen, and my only safety lay in imitating them down to the last detail." Well, I don't agree with imitating them down to the last detail, because I believe each one of us has a deep social responsibility, particularly the scientist.

This age is a scientific age and as we look into the future, if there is a future, it will be more and more a scientific age. The dynamo that keeps things going comes from science, and the scientist therefore holds the key for the important knowledge of the day and the direction of future knowledge. This is not knowledge which exists in a vacuum, it is knowledge which exists in the matrix of a society of human beings and it is up to the scientist to express himself, to make himself clear, and to take part in the affairs and the decisions of that society. The day of the ivory tower as an ideal is over. I do not question any scientist's right to retire to that ivory tower; but, he must also know that he's doing it responsibly and not just as a matter of taste. Because, we do have this very basic problem of a

powerful science existing in a society which is dependent on it. Further, as time goes on, society is more ignorant of it, and less capable of understanding it, and thus less capable of assimilating it. This is a weakness of the educational system. We have a great deal of misinformation, not only about the content of science, but about the nature of the scientific effort and the scientific adventure. I therefore choose the title of my topic, "The Implication for Religion of Scientific Advance." The reason I put it this way is because as science developed there has been a very close interaction between the two.

Many people want to say that there is no conflict between science and religion, that they occupy separate fields. Of course, this is not true. Observe how people act and you will see that there is a conflict and, to my mind, a necessary conflict. But, I would like to say that this is a conflict in the nature of a Civil War. It's a conflict between two groups who are trying to do the same thing in a different way. And if we understand this, we will feel better. Since the time of Galileo, the conflict between science and religion has sharpened. I want to read a few words that I've written about this. "In any attempt, to say that there is no conflict only results in a devaluation of both aspects of science and religion as a powerful urge of the human spirit. For the urge to comprehend the visible and invisible universe and to find man's place within it is common to both science and religion." The conflict between science and religion is between two parties with the same ultimate aim of comprehension and submission to a higher order of knowledge and insight. In these matters, religion has always taken the lead.

Questions about man's place in the universe and his origin have to be asked in each generation. The ancient Hebrew could not wait for the discovery of the neutron and the development of the theory of stellar revolution, or for Darwin, Morgan, and Watson to explain the variety of life and the origins of man and the universe. The noble opening lines of Genesis can not fail to move the most skeptical scientist even today. By means of dramatic imagery and lofty poetic insight, religions have provided world systems, more or less complete; which gave immediate satisfactions to the yearnings of man for order in the world and guidance in his life. They gave him release from certain fears, though they sometimes substituted others in their place. The great human quality of faith was always a basic prop to these religious structures. Religion and religious systems, to be fully effective, had to become established in law and custom. In a certain sense, their statements have to be regarded as self evident. Now, compared to the

eagle flight of religious thought, science is more like the humdrum earth-bound bulldozer. Where it has passed, anybody can follow. Religion is aristocratic while science is democratic and leveling. When the bulldozer passes, a tangled jungle or many beautiful gardens and buildings enshrined in history and sentiment may be destroyed. But the ground is ready for newer, and perhaps even more interesting, and beautiful cultivations, or perhaps not. In any event, a new generation gets a fresh start.

Now, it is often said that science gives man knowledge but does not tell him what to do with it; and this, I think, is not true. The great writings of the humanists and the holy religious script have done much to excite men to noble and charitable actions as well as the act of folly and cruelty. I feel it is not up to every person to set up a complete system of ethics from the ground up. In the first place it is far beyond the capacity of most of us and it is really not the way we live and do things. We do things much the way one does a budget. You don't reconstruct the whole university each year. You have a going concern and you add something here and subtract something there. In the same way, as you grow up in your family, you acquire living, practical ethics, from your family, your relatives, your friends in school, and religious and ethical teachings. You might even have your ideals expressed in the history of your country. As Americans we have the great example of the Declaration of Independence, and the Constitution. So you start at a point where you begin to think about impressions. You start with something which has become internal to you in the sense which Father Henle described so well.

Then the question comes - where do you go from there? You start with a commitment constructed within you. But for all you know, there may be certain basic things that are already there which you think are conscious but which are not, in the sense of ethical commitment. In an evolutionary process man was always a social animal. He had to have certain bounds in the social direction to survive at all. Here is a great unexplored field which we will understand much better as time goes on. But, in addition to these you reach an age with certain ways of looking at the world. There may be certain conditioned ways of acting, which have become natural to you, three-dimensional space, time, the things which condition the very nature of your behavior, and the way in which you start all your thoughts. Or they might be on a personal plane without reference to wider surroundings.

What the advance of physical science has done is to show us how very often the apparent is an illusion. The Copernican revolution, and what followed, displaced man from his comfortable and natural place, a place which gave him a feeling of special worth and significance in the center of the universe, and put him off on one of the planets, perhaps one of the minor planets going around the sun. We are just in a particular galaxy among billions and billions of galaxies, forced to think about our basic means of existence, or to think about the meaning of meaning when we consider totality. Then we come further, as we did in this 20th Century, and find that the very concepts of space and time, bred into all our habits, are insufficient to understand the whole. We find that the nature of time or space is far more subtle and entirely different from our immediate experience. This forces one to doubt immediate experience. It forces us, if we think about it at all, to understand that we are an entirely different creature than we thought we were. We thought we were creatures set in a certain setting with immediate ground rules from our experience. But, through our perception, through our intellect, and through our understanding we have been displaced from the setting.

The latter becomes irrelevant when one has the capacity to comprehend the whole. So in this sense, the dignity of man, instead of being diminished by popular cheap centrality is actually heightened. This can happen to those that have been able to comprehend the mystery which is deeply hidden. It takes the greatest subtlety of investigation and understanding to discover it. It is in this powerful impulse that you see man in a new role, not just living in a world and reacting to it, but seeking further by experiments, and by insight, to understand it.

It gives a meaning and a goal to man; to understand the universe, to understand himself, and to understand his nature. And, it is a goal which seems endless. Not in a sense of detail, but in the infinity of subtlety and depth. In the investigations of this century we've seen basic things go which we felt were absolutely a category of the mind rather than a property of nature like causality. Causality in the basic sense seems to be so pervasive and not a category of the mind.

Now we see that a still further subtlety is coming in when we try to understand our experiences in the atomic and subatomic level. Again we have a whole new world. One finds how extraordinarily different the world is made than one would expect from just an extrapolation from the ordinarily experienced and known. How infinite and rich it is.

When I hear people talking about the expense of doing scientific research I don't understand what they mean. How can people worry about a few paltry billion. Sure it is a large number, but really it is not so big. Those of you who work for the Air Force know this. How can people worry about a few paltry billion which takes the human race into this adventure, into this understanding.

I have just talked about what has happened in physics. I do not want to talk about biology; because, I'm very far from being knowledgeable about it. But one sees, as a layman, that we're beginning to understand how we're made. And, again, it turns out to be much more subtle and more complicated than past conceptions. The advance of science brings masses and masses of knowledge of detail but brings extraordinary simplicities at the same time. What could be more simple, when you get down to it, than the basic ideas of the genetic code, for example. The whole story may be complicated, but it is basically just a language. Language in a book may be terribly complicated, but at least the idea of a language is a wonderfully simple notion. And, there is a simple code in which the most complicated and fantastic things are expressed. Or, we're beginning to learn something about the operation of the brain. A fantastic thing which is able to do these wonderful things which we perform all the time.

So, it seems to me that we are living in the world and will continue to live in a world, where the ordinary individual finds himself in this situation. He has been raised in a certain way and comes to treasure certain things, and as he grows older he treasures these things more and more. The world changes, knowledge changes, everything he has learned becomes obsolete. He has not learned enough or acquired an attitude so that he is a part of this stream of change. He is simply like a cork bouncing around, or a canoe shooting rapids except he has much less control than a man with a paddle. I've seen highly intelligent, educated people, hate and loath science because they have no way of getting a hold of it, and there it is throwing them about. This reminds me of Pauli, who had an assistant who was a very brilliant man, I won't mention his name, because he finally fired him. He said, "no sooner had I understood what he had said when he showed that it was wrong."

This is the nature and the frustration to which most of the educated public is condemned under our present system of education. This is the kind of general education which treats all departments equally. What we need in order to understand, and to live in a world of change, is to have some common

things in the education of all. There must be a central core of science, but not simply an assemblage of facts. That of course is worthless.

Science has to be taught organically. I mean as a living tradition which is surrounded by a matrix of values and of qualities. It has to have some higher quality in it, and not merely facts. This is the problem, and our educators must find a system of study which will help give us a more unified culture on which we can base, what I hope would be, a more unified ethic.

FLOOR - You mentioned, Dr. Rabi, that religion is aristocratic and science is democratic. I would like to suggest a modification. It has been my experience that the opening line of the Declaration of Independence, "Endowed by our Creator with certain inalienable rights," is more democratic to a religiously-oriented person than anyone else. I feel that the religiously-oriented person believes that man is made in God's image and likeness. Whereas, many times the mechanistically-oriented person, and I don't necessarily equate him with the scientist, will turn right around and say, that's just Fourth of July oratory. That's just catechism. And, immediately, he takes a skeptical attitude. Or he might say that this fellow makes \$15,000 and wears a white shirt, and this other fellow makes \$4,000 and wears a blue shirt, men are not basically equal. So, this naturalistic point of view then is not democratic.

DR. RABI - I think that the opening lines of the Declaration of Independence are great but I don't know how to answer your question; because, it wasn't a question. I think Plato said, "Brothers, God has created you equally, but fashioned you differently." I was talking about religion and comparing it to science in a sense of an on going concern, in which sense it's very different. I was talking about organized religion, not talking about isolated prophets. So, I don't know how to approach your point.

FLOOR - I would like to ask you to clarify a point which you raised but did not particularly develop. You talk about the progress of science giving meaning to humanity. On the other hand you talk about the apparent as an illusion. This was your phrase. Also, you made a remark about man's miraculous capacity to comprehend the whole, the universe in all senses. I'm interested in asking you about your view with respect to the mere appearance of, and true, sensory experience. Do you debase sensory experience? Or, do you see a place for the real live world, the world from which science must come out of?

DR. RABI - I accept the universe, I enjoy my meals, I like to look at pictures, and I like the feel of nice things. And, in the dark I know how to grope my way from one point to the other. This is the way we were equipped to live. The point I was trying to make is that we can go beyond this and show why it is and reveal a richer and broader reality below the diversity of things that we see. We can see a more basic reality of an entirely different kind. In other words, I can go into the structure of this table's atoms, electrons, nucleii, and the structure of the nucleii. There are still more remarkable things of a very broad and wonderful way; but, the behavior is quite different from what you learn in order to get around this table with the sharp edges. I don't think there is a conflict between us.

FLOOR - I don't believe there's a conflict. The very fact that you refer to the constructual apprehension of physical objects, such as a table, as more rich than sensory experience is already succumbing in some sense to a metaphysic.

DR. RABI - I'm willing to give up that word if you don't like it and say more significant.

FLOOR - You seem to have placed the emphasis on the physical and on the understanding of the physical as being of prime importance. In this relationship how does this understanding of the physical world, in its entirety, relate to our contacts with one another?

DR. RABI - This is a very very basic question. The history of physical science, has given rise to ways of thinking and it has enabled us to understand other things. In this day and age, even those who are entirely ignorant of science speak and feel quite differently from people 100 years ago. The way of thought has been influenced by the progress of science. Now, I suggested that we are going to learn more about these things, and, at the present time, one has to accept answers which often cannot be found other than in experience. An engineer may not have full data, but he has to make a decision. He makes an engineering decision and he puts in factors of safety. This is what we have to do. It is in that sense that I differentiated between the function of religion and that of science. Basically, we cannot now differentiate, as far as I know, but maybe the sociologists or the psychologists have an answer.

What room do you have in your relations with people for arbitrary and free action, and in what way are you compelled,

within limits, to act the way you do? You are all familiar with the case where you see your friend confronted with decisions and agonized about making them but his friends know what he is going to decide and he is the only one who doesn't know. There are these regularities which I think we will learn to understand. I am certainly not going to use quantum theory and give you an answer to that, but I am quite sure we will know more but we will not know the end.

FLOOR - I would like to say something regarding your statement of the few paltry billions that are spent on research and the public attitude towards this. I feel that the public feels that they are not really sharing in the areas of knowledge that are being explored. In a sense, they don't understand. The billions are spent and the enjoyment and the satisfaction come to the few who comprehend and do the research. First of all, I would like your comment as to whether this is valid and, whether the public has an argument when they say that they're being taxed equally but not sharing equally.

DR. RABI - I agree with you completely. I think the scientists are very much at fault for living as an elite with one another, developing esoteric language, and very often where it is not necessary. They have very little regard for their public, for their educated fellow citizens. They are not trying to bring them along or to join with them in their sense of excitement and understanding so that they become part of it. You can be a part of something without actually participating. The scientists have not done anything of this sort, and, as long as they have no problem of getting support, they are not likely to do it. At another time they ran into opposition. Galileo said, that he had to spend eleven months doing philosophy for every month he could do science, because he had to fend off the opposition. Now scientists have become, in a way, fat calves and have not been responsive to this great need. There are very few reports that are worthwhile; and, furthermore, we need reform in the educational system so that it would be possible to write more intelligently about scientific matters. You can put forward some simple terms. I think this is a big problem of the scientific community. I said I think science is democratic in the sense that anybody can share in it, but scientists have done very little to let John Q. Public share the feast.

FLOOR - I suppose that you've more or less answered this question. These matters of communication become rather complex; and because there are various limitations among people.

Perhaps they can never understand some of the details. But, do you think there is enough effort to reduce some of these things, like the genetic theory, to terms which are simple enough that the layman can appreciate, and have considerable insight, and yet not be bored with.

DR. RABI - I think there is not enough effort on the part of first class people to do it. I see nothing impossible in the nature of it. Of course, we don't expect everybody with an IQ from 40 up to be able to appreciate it. To begin with, let us talk about the educated class which is a pretty big group of people in this country. They ought to be able to share in it. They ought to be able to read about it, and in a style of English that has some literary merit. Most of the published material is written down to people. It is really pretty poor and I think we need a conscious, concentrated effort in that area, especially for young people.

DR. LEHMANN - AFIT - The title of your talk was, "The Implication for Religion of Scientific Advance." I fail to see the implications for religion. Would you enlarge on that.

DR. RABI - I did not want to spell it out. I think my colleagues Father Henle, and Father Clarke, saw what I was getting at. I didn't want to talk about religion, as I said, but since you're compelling me to do it I will say that the advance of science purifies religion. Religion no longer has to deal with problems it cannot handle. It no longer has to deal with things with which science has dealt. Of course, the advance of science constantly presents problems to religion. If the religionists are on the ball, they will know when not to argue. I mean, for example, evolution and things of that sort. They have to know when to quit. It is very hard to give up doctrine because, it is supported by an organization. And, religion has to be supported by an organization. Religion has control of life and death. So, it is not easy for them to give up doctrine. In addition to that science confronts religion with actual problems. For instance, where there is a doctrine and new knowledge appears to refute it. How do you change definite religious precepts? Scientific advance encourages that. I cited Galileo and Darwin but I could easily have talked about the present day. I do want to say, one more thing. There has been wide misunderstandings among some religionists about the meaning of quantum theory and the uncertainty principle. I want to state this unequivocally. There is no room for miracles, within the scientific system, just because of the uncertainty principle.

FLOOR - Do you feel that, as science advances, religion will be borne out or replaced? For instance, could science prove that there is a personal God? Or, is there still a place for religion?

DR. RABI - We speak about religion in general and not all religions have a personal God. Many religions have a whole pluralism of Gods. Go to India and they are all over the place. The type of religion I was talking about was that kind which tries to give man a place in the universe and base conduct on certain precepts supported by religion and interpreted through religion. I was not talking about 'The Big Three' or I was not speaking in ignorance or trying to illuminate the meaning of prayer.

FLOOR - Would you comment on the conflict between science and religion which you mentioned? Do you mean one between religionists and scientists or a more basic conflict?

DR. RABI - I meant that a basic conflict where you have two movements; one that is a practical one that has to give answers at a particular time, and another one which goes by a different system, more exact and definite. So that religion, in a certain sense, when confronted with science, fights a rear-guard action all the time. At least that has been so historically. I meant the conflict that is an inevitable and necessary one because of the different nature, the different approach these two disciplines make to the same question. The aim of science is understanding and it gives you a basic understanding. It also enables you to understand the consequence of your action and I do not see how you can make any moral judgments without understanding the consequences of your action. And science, I think, is teaching you the consequences of your action. It doesn't cover the whole waterfront. It is an unfinished business and I think it will remain an unfinished business as long as the human race exists and is interested in this sort of thing. It does teach you the consequences of your action but it leaves the realm open for moral or ethical judgment.

PROFESSOR NAGEL'S TALK

MAJOR DUNN

Our next speaker is Dr. Ernest Nagel, John Dewey Professor of Philosophy at Columbia University since 1955. He has been teaching at Columbia University since 1930 and is the author of numerous books and publications, including "Logic Without Metaphysics" and "The Structure of Science." His talk on "Reason and Religion in Ethics" should open a new facet in our Symposium. It is with real pleasure that I introduce Dr. Nagel.

DR. NAGEL

Thank you Major Dunn. I am very pleased to be here. I am appreciative of the honor of being asked to take part in this discussion, and certainly it is an enjoyable prospect to be able to talk about important questions in a serious way and to a serious audience.

Since the word "philosophy" appears in the formal title of this Symposium, let me introduce what I want to say by indicating what I think philosophy is about. Historically, there have been a great variety of approaches to philosophy, and even today professional philosophers see the subject quite differently, often in conflicting ways. There are not simply different divisions of interest among philosophers, but often an intellectual warfare is carried on between members of opposing schools of thought. In any case, I myself think of philosophy as a generalized critique of human beliefs, and not as an attempt to make new discoveries about the nature of things. It is a critique of man's claims to knowledge and of man's values, with the intent to examine and assess the grounds on which those beliefs and values are maintained, and to examine how they are related and what they imply about man's place in the scheme of things. This is my conception of philosophy; and it should be understood that in what follows it is I, and not philosophy, who is speaking, and that my talk will at best be only an approximation to the ideal of philosophy that I have stated.

Perhaps the briefest way of describing philosophy as I would like to practice it is to recall the words of William James that "philosophy is a persistent effort to think clearly." One doesn't make this effort about all matters and at all times; for as Whitehead once remarked in discussing mathematics, much that we do is done, and should be done, simply as a matter of course and settled habit. Thinking is too precious an article to be used too often. "Operations of thought are like cavalry charges in battle -- they must only be made at decisive moments."

But however this may be, I want to talk about religion and ethics, and to offer a partial critique of these domains of human concern by examining some of the issues raised by them. Let me begin by noting that the word "religion" is a vague term whose delimitation is hard to fix, and that consequently many of the conflicting discussions of the subject fail to deal with a determinate range of fact. However, if one thinks of religion as a historical phenomenon, we can fix the reference of the term in a fairly definite way: it is an organized social activity which is associated with what I think we must call a supernatural interpretation of the way things are. At any rate, as I read history, this is what religion has been. It seems to me imperative, on pain of gross confusion, not to define religion as something cut off from what it has been historically, and not to conceive it as something entirely different from certain organized social practices and the creeds or doctrines associated with those practices. In my view, therefore, there are two important components in all the historical religions: a component of creed or doctrine, and a component of ritual and practice. Indeed, this view is in full agreement with the definition of religion found in dictionaries: "Religion is the recognition on the part of man of some unseen higher power as having control of his destiny and his being, and which is entitled to obedience, reverence, and worship." Accordingly, since religion involves a belief in some higher power which allegedly deserves all these attributes, religion should be distinguished from theology. For theology is an attempt to rationalize the content of belief. Indeed, it is possible to imagine a theologian who has no religious beliefs, whose task it nevertheless is to put a certain set of religious beliefs into some kind of coherent order. But in any case, I will be concerned in what follows chiefly with the doctrinal content of religion.

But before turning to a critique of some aspects of religious creed, let me say that religion as a ritual and a practice performs a great number of important and often indispensable social functions -- functions which are indispensable in the sense that usually no other social institution performs them. For example, Professor Rabi suggested this morning that religion commonly plays a role in men's lives at moments like birth, marriage, and death. I take it that the intent of his remarks, although I am not sure of this, is that we feel these critical events in our lives to be too important to let pass without special notice. We want to celebrate them in some fashion and we frequently celebrate them by taking part in a ceremony that is associated with a church or a creed, even though we may not understand or even believe the creed. Just having the ceremony performed is something that satisfies a deep need in all of us, whatever our specific beliefs may be.

There is one other aspect of religion that I want to mention in passing, before I turn to some comments on religious doctrine. Religion is sometimes conceived as an inclusive attitude toward the world and as a generalized quality characterizing a person's life. Thus, a man may not be religious in the sense that he subscribes to some specific set of doctrines or belongs to some established church and practices its rituals. Nevertheless, because of his general attitude toward the world and the human scene, he may nevertheless be said to be deeply religious. For example, Einstein has often been characterized as a religious man because of the kind of life he led and the conception of the cosmic background against which he viewed human destiny. Now although I will be critical of religious doctrine as a guide to human conduct, I do not want to be understood as being insensitive to religion construed as a comprehensive attitude many persons exhibit toward man and nature. This attitude is a generalized one, which represents a perspective upon man's place in nature, and is not directed toward any specific set of actions which would distinguish those performing them as members of a distinctive religious community.

Let me now turn to some observations that I recognize to be debatable ones, and that I am sure will be challenged by some of my colleagues. It is today widely recognized that every conclusion advanced in any of the specialized sciences is subject to correction, and may be replaced by another one that is better grounded. Indeed, a large fraction of the findings that were accepted for a time as well-founded scientifically, have eventually been replaced. Nevertheless, despite this impermanence of scientific conclusions, there is also something which remains fairly constant in science and which distinguishes the scientific enterprise from other ways of trying to achieve knowledge -- namely, its method or logic of inquiry. Science employs a distinctive logic which permeates every particular investigation undertaken by it; and though the conclusion of a particular inquiry may have to be eventually revised, the logic underlying the sequence of inquiries is something which is relatively stable. Incidentally, the religious attitude to which I briefly referred a moment ago represents something analogous to what I have called the logic of science. For like the latter, it is something that is relatively stable, and involves a commitment to certain values, to certain comprehensive standards of conduct, but in addition also to certain general notions as to what is excellent in man. Thus, although a person's beliefs about specific questions may change, and his assessments of what actions should be undertaken on particular occasions may be revised, his over-all methods for establishing beliefs and making value assessments undergo relatively little change, just as in the case of the scientific enterprise. The quality of a person's over-all attitude is what constitutes his distinctive character, just as the self-corrective method of the sciences marks them as a distinctive area of human endeavor.

In the light of this general observation, I wish to make a few comments about traditional religious creeds, though because of lack of time my comments must be stated dogmatically. Many religious doctrines have attempted to describe and account for the nature of the cosmos; and it is well known that the various doctrines about the physical universe which historical religions have propounded have not stood up in the light of scientific advances. However, what I wish to stress is not that the accounts of the world which form a part of most religious creeds have proved to be erroneous. My point is rather that such accounts have usually been advanced and accepted by religious groups as infallible truths, so that no provision is made for their modification because of fresh evidence that is gathered by critical inquiry. On the other hand, science makes no claims of finality for its findings; its conclusions are advanced tentatively, though on the basis of a self-corrective method of inquiry that evaluates evidence in terms of principles that no reasonable man can reject. It is on this score that science as a way of discovering the nature of things seems to me so superior to any proposed alternative. In my view, therefore, religious creeds that offer accounts of the way things are as something final and beyond rational criticism are essentially illiberal and reactionary. I do not hesitate to use strong language in this connection, for the point at issue is too important to be side-stepped by employing polite but mincing words. I do not believe there is any warrant for the claim so characteristic of traditional religions that they provide a superior avenue to an understanding of the world we inhabit; and by maintaining that their accounts of the nature of things are definitive and beyond scientific scrutiny, they have discouraged if not actively opposed the growth of free scientific inquiry.

The historical religious accounts of the way things are have been supported, and continue to be supported, by numerous arguments which seek to show that scientific explanations are ultimately unsatisfactory and must be supplemented by supernatural ones. Although time is lacking for discussing any of these arguments adequately, I want to consider two of them briefly. One of them, used by no less a thinker than Sir Isaac Newton, argues to the existence of God in order to guarantee the continued stability of the solar system. Thus, although Newtonian theory was able to describe and explain the motions of the planets, he was unable to show that the perturbations of planetary motions because of the mutual influences the planets exert upon one another will not eventually lead to the destruction of the entire solar system. He therefore suggested that the existence of God who keeps the system running by patching up from time to time flaws in its operation must be assumed. However, more than a century after Newton, Laplace tried to show that if the Newtonian laws are assumed to hold, the solar system is in fact stable. Laplace's alleged proof has been challenged as

inconclusive, and I am certainly not competent to evaluate the current state of the question. My point is a different one -- that the postulation of God's existence is not required for understanding the way things are. In the first place, why must it be assumed that the solar system is indefinitely stable? But secondly, whether or not the system is stable, in each case nothing is gained by introducing a supernatural agent to explain the supposed fact -- for the stability as well as the instability of the system can be explained in terms of the mechanisms that are assumed to operate in the system.

A more recent attempt (by Dr. William G. Pollard in last year's Symposium at this Laboratory) to account for nature of things in terms of God's existence is based on the assumption that all laws of nature are statistical or probabilistic. According to this argument, every natural occurrence is theoretically highly improbable; and a Divine Agent or Providence is therefore held to be needed to explain the fact that the improbable does happen. This seems to me a remarkably weak argument. Let me first comment on the assumption that the laws of nature are all statistical or probabilistic. Since I am not a professional physicist, perhaps I ought not dispute with Dr. Pollard who is one. However, I must call your attention to the patent fact that some laws of physics are not statistical -- for example, the laws of mechanics, whether they are the laws of Newtonian or Einsteinian mechanics. Nor does it follow that because quantum mechanics is currently held to be the basic physical theory and to be a statistical theory, that all laws about macrophysical phenomena are also statistical. But in any case, it is a curiously disparate argument which invokes a Divine Agent to make intelligible the occurrence of improbable events. For if God's existence is needed to explain the improbable in physics, it is also needed to make intelligible the fact that any given set of cards -- though theoretically improbable -- is dealt to a player on a particular occasion. In short, since on this argument God's existence is being used to account for any happening only after it happened, God's existence explains nothing whatsoever.

There is a variant of this argument which requires some attention -- the variant according to which the fact that there is much "design" or "order" in nature indicates the operations of Divine Designer. This so-called "teleological argument" for God's existence has impressed many first-class minds, and I do not wish to minimize its strength. We must certainly admit that there are forces in nature which sustain human life and make possible the realization of a great many human ideals. We couldn't achieve many of the things we have achieved unless nature did possess the characteristics which enable us to do these things. But in

recognizing this, we must also recognize that there are disruptive forces as well. One might like to see the disruptive forces minimized but there is no reason to suppose that they will be; therefore, the supposition that a divine agency will support our confidence in the continuance of an order of things which will help to realize our hopes and our ideals, is a confidence that has no foundation. Some sixty years ago Bertrand Russell said superbly what needs to be said on this important point; and with your permission I would like to read a few lines from his famous essay, "The Free Man's Worship." "Man is the product of causes that had no prevision of the end they were achieving. His origin, his growth, his hopes and fears, his loves and beliefs, are the outcome of accidental collocations of atoms; and no fire, no heroism, no intensity of feeling can preserve an individual life beyond the grave. All the labors of the ages, all the devotion, all the inspiration, all the noon-day brightness of human genius, are destined to extinction in the vast death of the solar system, and the whole temple of man's achievements must inevitably be buried beneath the debris of a universe in ruins. All these things, if not quite beyond dispute, are yet so nearly certain, that no philosophy which rejects them can hope to stand." I will confess that it is on a view of things that accepts in substance Russell's description that I myself take my stand.

Since my comments on religious doctrine have been so wholly negative, it might be well for me to remind myself of an oft quoted aphorism by Francis Bacon, in which he declared that "A little philosophy inclineth man's mind to atheism but depth in philosophy bringeth man's mind about to religion." Bacon may be right in his dictum. But if so, I must repeat the very just observation of George Santayana that the religion to which we are brought back must surely be very different from the religion which we abandoned. For to say that the religion to which return as a consequence of acquiring greater philosophic depth is a purified religion, is to acknowledge that the religion we then embrace is not the one that has been institutionalized in various forms and in many places throughout the centuries. It would in any case be absurd to suppose that the net outcome of philosophical reflection on religion is simply to reaffirm the superstitions and condone the brutality and intolerance that are so intimately associated with the major historical religions.

Let me now turn to the question whether religious beliefs are inextricably linked with morals and ethics. There is no doubt that many people are firmly convinced that religion is the foundation for any adequate ethical system. It is often maintained, for example, that without a belief in a Divinity or in a Divine Order which prescribes certain kinds of actions as moral and other actions as immoral, there is really no firm basis for any moral

judgments we may make or moral values we may profess. But this claim must face and try to answer a question of paramount importance. Are moral precepts validated by their origin or source, whether Divine or otherwise? Or is the validity of a proposed moral rule to be evaluated on other grounds, irrespective of the source from which it supposedly originates? However, to maintain that an action is good simply because God, for example, commands its performance, is to reject our birthright of reason; for though God may have commanded the action, we must be sure that God's commands are not arbitrary and deserve our compliance on moral grounds. Thus, God allegedly ordered Abraham to sacrifice Isaac; but that does not settle the question whether the order was morally justified and whether Abraham was morally warranted in complying with it. Accordingly, we are confronted with two alternatives, between which we must choose. If a moral principle is to be accepted as sound merely because it is enjoined by some Divine Agent, we are abdicating a rational foundation for morals, and substituting in its place an appeal to sheer power or force. On the other hand, if a moral principle requires to be evaluated in the light of whatever rational methods we have available for validating moral judgments, then no religious foundations are needed for establishing the worth of any proposed system of moral values and moral rules. I myself have no hesitation in accepting the second alternative as the only one that is compatible with human dignity and the demands of a liberal conception of human life.

The importance of basing moral ideals on independent rational grounds, rather than on the alleged commands of a Divine Being, cannot be overstated. The importance of doing so was stated with characteristic clarity by John Stuart Mill, a 19th century British philosopher, in his comments on what is commonly called "the problem of evil" -- the problem that has challenged religious thinkers throughout the ages, and is generated by the assumption that there is a God who is not only omnipotent but also omnibenevolent. For if God is all powerful as well as infinitely good, why is there so much evil in the World? Why are upright and innocent human beings so frequently subjected to cruel and senseless suffering, while the wicked so often live lives of splendor and enjoyment? One familiar answer to these questions is that God's ways are beyond human comprehension, that what seems to us to be evil is not really evil, and that if we understood the nature of Divine goodness we would recognize that the things we call evil are really good. To answers of this type Mill made what seems to me a conclusive rejoinder: "If, instead of the 'glad tidings' that there exists a Being in whom all the excellences which the highest human mind can conceive, exist in a degree inconceivable to us, I am informed that the world is ruled by a being whose attributes are infinite,

but what they are we cannot learn, nor what are the principles of his government except that 'the highest human morality which we are capable of conceiving' does not sanction them; convince me of it, and I will bear my fate as I may. But when I am told that I must believe this, and at the same time call this being by the names which express and affirm the highest morality, I say in plain terms that I will not. Whatever power such a being may have over me, there is one thing which he shall not do: he shall not compel me to worship him. I will call no being good, who is not what I mean when I apply that epithet to my fellow-creatures; and if such a being can sentence me to hell for not so calling him, to hell I will go."

Let me now make a few comments on the relation of ethics and science. The claim is often made that moral judgments have an utterly different basis than do scientific ones. This claim is related to Father Henle's talk this morning, in which he called our attention to the fact that we must make a choice between different intellectual methodologies in our attempt to deal with the world. In any case, there have been many influential and serious minded thinkers who have maintained that ethical propositions must be evaluated as sound or unsound in terms of a method which is very different from the method of positive science. In consonance with this view, there are certain matters which the method of science cannot handle, one of them being the validity of ethical judgments. Much would need to be said on this issue, but I can touch on only a few of them, and will hope that my remarks can be amplified in the course of the discussion from the floor.

Science is sometimes compared with a map describing the geography of a territory. Such a map indicates the mutual distances and directions of various places, but does not tell us anything as to where it might be desirable to go. Thus, it is useful to consult a map if you are in Albuquerque and wish to go to Santa Fe, for it will supply information concerning the direction you should take to arrive at your destination; but a map will not answer the question whether you ought to go to Santa Fe or anywhere else. On the other hand, the function of a moral principle is said to be that of telling us what actions we ought to perform, which ones to avoid -- in short, its function, unlike that of a map, is to instruct us "where to go." Accordingly, science can at best inform us how certain objectives or ends can be achieved, provided that those objectives have already been selected as desirable on non-scientific grounds.

This account of the difference between science and ethics is at first brush quite plausible, and in any case has considerable merit. Nevertheless, I do not believe that the sharp contrast drawn between them will stand up under scrutiny. In the first place, a little reflection shows that since no map represents everything that exists in a territory, maps are highly selective and describe only what are assumed for various reasons to be the "important" landmarks. Accordingly, before a map can be constructed, some assumptions have to be made as to what is worthwhile having represented on it, as well as what modes of representation are to be employed. But similarly, all our intellectual activities, even in science, are selective, and involve assumptions concerning what things merit the effort and expense needed for carrying on inquiry into them. For example, Professor Rabi in his talk called attention to the fact that science satisfies certain deep human desires for understanding the world around us; and someone in the audience subsequently challenged the adequacy of this justification of science, on the ground that in providing understanding science is satisfying only one impulse or need of human beings. The challenge seems to me to have been a perfectly proper one to have made. For it called attention to the fact that our physical and human resources are limited, and that we have to distribute among alternative goals. How to distribute them is clearly a moral question, at least in part, and we have to adjudicate between the often conflicting claims of desires for knowledge, creature-comfort, artistic expression, and the like. Indeed, even within science decisions must be made as to whether, and if so how much, financial and other resources should be used for high-energy research, the development of space probes, geophysical study, biological inquiry, and so on through a long list. Accordingly, the assumption that science neither presupposes nor is engaged in making value judgments is not tenable, and must be qualified.

The second point I wish to make is that a rationally conducted ethical inquiry can yield directives as to what is valuable and what ought to be done, only if various general assumptions or interpretative principles are taken for granted. Human beings are born with certain impulses and drives, acquire others, and our lives consist in large measure in satisfying or redirecting them. However, the mere satisfaction or denial of impulses and desires is intrinsically neither good or bad, and our responses to them acquire a moral value in terms of the relations between those responses. For example, the fact that I happen to prefer one flavor to another, or that I happen to enjoy seeing people happy rather than unhappy, has no moral significance when taken by itself; and it is a common error to identify moral values with our immediate likings or dislikings of various items of experience. On the contrary, our immediate responses to things acquire a moral

dimension only when our immediate preferences and aversions are interpreted in the light of general principles which exhibit the relations in which a large complex of human responses stand to one another.

In the light of this brief sketch of what is involved in ethical reasoning, it is clear that there is a strong resemblance between the logic of moral inquiry and the method of positive science. In the latter as in the former what is directly or immediately experienced must be interpreted in terms of general principles before it acquires a cognitive status. For example, some things are directly experienced as large and others as small, just as some things give us immediate pleasure while others do not; and there is no question but that we experience these various matters in the manner reported. But whether the thing we directly apprehend as large is really large -- or whether the thing experienced as pleasant is really pleasurable and therefore valuable -- is not decided by the immediate experience. We must analyze and interpret our immediate apprehensions of things with the help of general principles that indicate the various relations in which the given data stand to other things.

The question naturally arises as to what is the source of such general principles of interpretation, whether in positive science or ethics. However, in trying to answer it we must make a distinction between the psychological and the logical aspect of the problem. If the question is understood to ask for an account of how we come to invent or arrive at such principles, the answer is that we know relatively little about the way ideas originate or about the conditions under which men make intellectual discoveries. According to a well-known story, Galileo found a connection between the period and length of a pendulum by observing the swinging lamps in a church -- but there is no reason to believe that church goers are more likely to make discoveries in science than those who do not frequent churches, for while some men may obtain inspiration from a church others obtain it from drink, from tobacco, and from much else. A few years ago the distinguished French mathematician Jacques Hadamard published a book The Psychology of Mathematical Invention, in which he surveyed the literature on the subject, and reported on the answers to questionnaires he had submitted to outstanding mathematicians asking them to describe how they arrived at their mathematical discoveries. Many who responded to the questionnaires said they frequently fell asleep with problems on which they had been working still unsolved, but woke up next morning with solutions to them. Hadamard concluded that the solutions are often the work of the "unconscious mind." However, this conclusion

is not an illuminating explanation, unless indeed we are ready to believe that anything is explained when we baptize our ignorance. In short, we know very little about the way men hit upon new ideas, whether in science or in ethics.

On the other hand, the question about the source of interpretative principles can be understood as being one concerning the grounds for their assumed validity; and it is this logical question, rather than the question about the origins of principles, that seems to me the crucially important one. Now it is commonly said that ethical principles, unlike scientific ones, are incapable of empirical validation, and that they rest on non-empirical foundations -- for example, on their supposedly self-evident rationality. In my judgment, however, both scientific and ethical principles (or theories) can be, and indeed must be, tested by reference to matters of empirical fact. Perhaps the main difficulty people have in recognizing this is created by the widespread belief that since moral deliberation about what ought to be done on a given occasion involves assumptions as to what is valuable, all moral judgments presuppose some ultimate set of values which are beyond further justification. But this is a non-sequitur. Thus although every experiment in physics takes for granted various interpretative principles, it does not follow that these principles may not need to be revised in the light of empirical tests conducted in a subsequent inquiry. Similarly, the values taken for granted in a given moral inquiry may be reassessed (and perhaps modified) in the light of what a later inquiry may reveal about the observable consequences to which human action in consonance with those values leads. Accordingly, neither an appeal to observed fact nor an appeal to principles of interpretation has an absolute priority in inquiry -- alleged fact may need correction in the light of assumed principles, and assumed principles may be revised in the light of observed fact. Any given statement whether of fact or principle, and in ethics as well as in science, has the logical status of a hypothesis; and though we may have greater warranted assurance for some statements than for others, in no case are they beyond the possibility of revision because of the findings of continued inquiry. If I am right, the logic of moral judgment is in essentials the same as the logic of scientific inquiry.

I have taken more time than I anticipated, and will conclude with a brief confession. I cannot exaggerate the importance I place upon making moral judgments in a responsible manner; for I believe that much current as well as past evil has its source in the common human failing to deal with moral problems in an arbitrary and nonreflective manner. However, I do not think that moral judgments cease to be irresponsible if they are made

to rest on precepts and rules which are assumed to be beyond the critical scrutiny of continuing empirical inquiry. Human beings have a capacity for critical reflective thought -- perhaps unique in the entire universe -- which involves the use of method or logic that has gained for our race a progressively more profound understanding of both the animate and inanimate world. And I am convinced that the extension of this method to human problems -- whether personal or social -- can lead to achievements no less impressive and salutary. It is perhaps unnecessary to add that I am not identifying the method of science with the use of any particular set of specialized techniques: it would be as absurd to use the telescope in conducting an experiment in microbiology as it would be to use that instrument in settling a question in ethics. It is not the use of any particular instrument that marks the method of science, but the use of a common logic in weighing evidence, a readiness to test assumptions and amend them in the light of carefully controlled observations, and a willingness to penetrate the superficial appearances of things with the help of critically assessed principles of interpretation. Needless to say, there is no guarantee that by using this method the human race will survive the dangers that threaten it; but I firmly believe that the widespread use of this method is the most reliable instrument man has yet devised for creating the conditions for a high and liberal civilization.

MAJOR DUNN - Thank you very much Professor Nagel. We have a question from the front.

FLOOR - What is your purpose in life? Is life purposeful?

DR. NAGEL - I'm not sure I know how to answer the question - is life purposeful? I don't think that there is one entity that one can call life. I think that there are a great many living creatures and that they have a great many different purposes. Now, you could ask what is my own particular purpose; namely, this particular individual. This would be an autobiographical statement which would be of no interest except to me, and I don't think I ought to waste anybody's time by telling you what I really think are some of the things worth doing. One of them surely is to talk to people who are interested in this question.

GENERAL WHITE - I deduce from your discussion that you feel the burden of proof regarding the existence of a supreme being lies with religion. Would you say that there have been any discoveries of science to date which would deny the existence of a supreme being?

DR. NAGEL - This question is too important to dismiss with a few facile remarks. I hope you will not misunderstand me if I deal with it in a summary way. To ask whether there are discoveries which disprove the existence of a supreme being is like asking whether there are discoveries which disprove the existence of ghosts. We have no scientific evidence to indicate that there is a supreme being. To prove that something does not exist is an extremely difficult job and in many cases there is no way of going about it. One can show that many of the claims that have been made for the supposition that there is a supreme being are extremely debatable in the light of the available evidence. Thus, the question arises whether the existence of a supreme being is testified to by the course of human history -- whether the course of human history has been a progressive development from the inferior to the superior, or in the direction of greater value. In other words, we must ask what follows from the assumption that a supreme being exists; and we must then examine the consequences of the assumption, and determine whether they're in agreement with the available evidence. Now, it seems to me that none of the claims that have been made have been supported by the available evidence.

FLOOR - I always find something interesting about the types of people at a meeting like this. They tell us that scientific inquiry, the scientific method, is inadequate to describe the whole man. Then, when you ask a question about a supreme being they revert to the stance that there is no available scientific evidence. Father Henle said something about this. And, it just struck me Professor Nagel, that you may be slipping into an escape that....

DR. NAGEL - No, on the contrary, I feel that it would really be discourteous, to everyone present, to try to escape from a question of this kind and I want to answer in all honesty and sincerity. I don't believe that there are different methods for establishing claims to knowledge. I think there is just one method. There are many truths and there are many techniques. I don't believe that there is just one truth, I don't think there is just one technique for discovering truth, but I think there is only one logic for evaluating evidence. Obviously I'm not proving what I'm claiming. I'm just making a confession. Those who claim that there is a supreme being should specify what the content of that claim is. Very few people today would say that the supreme being is an old gentleman with a long beard. This isn't what they mean. They might say that the supreme being reveals his existence in the beneficial order of human history. This may not be one of the consequences everybody will draw from that assumption. But suppose it is. Then, on the basis of a

sober examination of human history, I say, I do not find such an order. Ergo, this argument for the existence of a supreme being it seems is not warranted by the available evidence. Perhaps you will go over my survey of human history and find that I made terrible blunders. Then, I will have to revise my conviction. But, in the light of the evidence I'm not prepared to accept it. Anybody who puts forward a positive proposal has to have supporting evidence and therefore I am rationally entitled to disregard the hypothesis and to deny the existence of something for which there is no evidence. That's why I took that simple example of a ghost. If somebody tells me there are ghosts roaming in the church yard every midnight, I say, maybe there are. But I don't believe that there are, and I'm right in not believing it; because, every bit of alleged evidence turns out to be spurious.

FATHER HENLE - I hadn't intended to get into this today since I understand that we're going to have a few innings tomorrow, but, I will in the light of the question raised in my direction. The reason I want to come in here is not to start an argument at this moment, but to highlight something that I think has become very clear. Professor Nagel has made it very clear that there is a basic difference in the analysis of knowledge in his view and in my view. When Professor Nagel says that there is no evidence for this, that, or the other thing, he is talking about his views with regard to what evidence is. And I would say, knowing Professor Nagel's position, that within the interpretation of his meaning of evidence and the kinds of evidence and logic he would accept as setting up the truth or establishing validity, whether it be absolute validity, temporizing validity, or theoretical validity, that there is no evidence for the existence of God. This cannot be encompassed within the narrow limits of Professor Nagel's view.

MAJOR DUNN - I think this is the time to go on to the next speaker.

PROFESSOR MARGENAU'S TALK

MAJOR DUNN

Dr. Henry Margenau is Yale's first Eugene Higgins Professor of Physics and Natural Philosophy. He is a leading authority on the philosophical foundation of physics and has made important contributions to the technical field of physics. He is the author of numerous scientific and philosophical articles and books, including his latest book, Ethics and Science. He has received many honors and holds a number of positions, including membership on the Commission of the World Council of Churches which is charged with the task of formulating a Christian attitude toward the problem of nuclear war. It is with great pleasure that I introduce Dr. Margenau.

DR. MARGENAU

When I left home, I was asked by a colleague where I was going. I said I was going to a Symposium on Science, Philosophy, Ethics, and Religion at Kirtland Air Force Base. I was then asked, "What is the interest of the Air Force Base in religion?", and the questioner went on, no doubt jokingly, to suggest: "I suppose these people are seeking ammunition to discredit the Moscow claim that they didn't see God in space." I withheld further comment. I am now equipped with reasons and arguments to convince this man that you, the men on this base, have a deep and sincere concern with problems wider than those involved with technology of the atomic age.

I am grateful for the opportunity to be here, appreciative of your invitation, and I relish this chance to exchange ideas, not only with my colleagues, but also with the men and women who constitute this audience. I think the comments that I am going to make will be complementary to those of the other speakers. Complementation will most fully occur with respect to the remarks of Dr. Nagel.

I would like to portray for you in the next few minutes the role which science plays in the larger context of human experience. Science is a style of inquiry. It is not a dead set of facts, not a complete or completable body of knowledge; it is a dynamic enterprise. It plays a very definite and definable role in human experience. By human experience, I mean anything of which we can possibly be aware. The Latin "experiri," from which our word "experience" is derived, connoted sensing, feeling, attitudes, moods, decisions, etc. These phases of consciousness all come within the field of human experience.

Now, according to traditional philosophy, a distinction is made between two elements of human experience. One component is labeled cognitive, the other noncognitive. First, I wish to state, somewhat dogmatically, that science addresses itself to cognitive experience. It endeavors to make sense out of those direct perceptions and observations which alone do not engender a harmonious or complete picture of the world. There are, on the other hand, noncognitive experiences, such as feelings, imaginings, and the making of decisions, which fall largely outside the cognitive domain. These are things of which science, at least in its present phase, does not treat.

To illustrate the meaning of cognitive and noncognitive experience, let me give an example. I am echoing in another sense, in another terminology, the distinctions made this morning by Father Henle, who contrasted notional understanding and personal commitment. When I make a distinction between house and home, I am advertiring to one such concept. If you sense a difference between the meanings of female parent and mother, it is the distinction between the cognitive and the noncognitive. I am saying that science, at the present time, is limited to the house and not the home, to female parent and not mother.

It is possible to distinguish two classes of cognitive experience. One goes by the name observational; the other involves ideas, the constituents of thoughts, concepts, and constructs. Since I do not have time to define completely the distinctions between these classes, I will merely appeal to your knowledge of epistemology and hope that you agree with me on this distinction.

There is something peculiar about the immediate observations of science. They are coercive; they assail us from without. They are incoherent, they are contingent; and, because of their character, we cannot form a world picture out of them. They are well characterized by Kant's famous phrase, "the rhapsody of perceptions." Their rhapsodic, incoherent nature forces us to formulate vis-a-vis the immediacies of our experience, certain constructs of reason. By rationally combining these constructs or ideas we form an understandable picture of the world.

I shall not belabor this point here, having given much attention to it on other occasions. But I shall indulge in a whim. I will draw a little picture* and I will refer to it when discussing religion. I shall speak of the cognitive component of experience which is contingent, in the sense in which I've outlined it, as the protocol form, the P-plane, the test plane of all scientific reasoning. Here are the observations of the scientists, the immediacies

* See page 60.

which surround us and which do not make sense by themselves. Over against them we construct concepts which I will call the C-field. Sometimes these concepts are not at all directly related to immediate experience, to protocol, perceptory, or test experience. Sometimes they are. Whenever the double lines exist they are called measurements in simple natural science. Measurements connect the sensation of hotness in my fingertip with the reading on a thermometer, which is objective, which is constructed in accordance with rules of reason, capable of bearing numbers, and therefore suited to engage the rules of mathematics.

Now, science is this sort of game. It starts with immediate observation and proceeds by rules of correspondence (the simplest type of which is measurement) to the field of reason, i.e., to the C-field. It establishes there certain constructs which entertain logical mathematical relations, allowing one to make calculations and then, sooner or later, by way of prediction to return to the field of protocol observation. If a theory is correct, the prediction must agree with the observation.

I would now like to discuss very briefly one item which has thus far escaped notice in our Symposium. It is the meaning of existence in science. The question has been raised repeatedly as to the existence of a Deity. As a preamble to any attempt at answering this question, I want to speak briefly of the meaning of existence in science.

In view of the problems that will later arise, it may be helpful to analyze a few of the scientific principles which involve the word "existence." What, for instance, does the scientist mean when he says, "Electrons exist?" He certainly does not imply that they are present within his experience in the same simple manner in which he encounters ordinary material objects. This is at once clear from the fact that electrons can never be seen or apprehended in the direct manner in which we assure ourselves of the existence of large visible things. Furthermore, according to modern physics, electrons do not even have positions at all times, nor some other visual attributes ordinarily assigned to objects, for they partake of the renowned dualism which makes them appear sometimes as particles and sometimes as waves. These are qualities unheard of for ordinary things. Evidently the electron is a physical construct which does not lie very close to the P-plane, but is something rather abstract, not to be conceived in a simple, intuitive, imageful way.

The claim that electrons are real means this. Suppose we postulate such entities, endowing them with a certain charge, a certain mass, and certain other qualities such as spin and Hamiltonian. These constructs now have the unique quality of being correlated to a variety of P-facts (protocol facts of direct observation) in a simple manner. Among these are observations on the flow of electricity in wires, liquids or gaseous conductors, the production of heat and light by currents, the behavior of photocells and a host of other physical facts.

In terms of the diagram, the electron, together with its qualities and properties, correspond to a small set of constructs in the C-field, some distance from the P-plane. From this set there emerge heavy lines, corresponding to measurement, connecting the set with many parts of the data plane. Because this compact theoretical structure is logically fertile, allowing so many successful circuits of empirical confirmations, we have no hesitation in declaring the set of constructs, that is, the electron together with its mass and charge, part of physical reality. That is the sense of the statement "The electron exists." In particular, no claim is made that the electron is directly perceptible, nor that it has the qualities of ordinary things, such as that of occupying a definite point of space at every moment of time.

Let us now turn to another proposition which may be called scientific: namely, the statement that man has a mind, or that human minds exist. Here the meaning of existence is even less obvious than in the foregoing example. What it asserts, if anything, is this. Man is capable of simple sensations like seeing a tree, or hearing a sound, or being engaged in a reasoning process like doing arithmetic or pondering over a construct like a number. These are simple experiences in the sense that we normally have them without being conscious of them. But we can also reflect upon them while being engaged in them: we can be aware of being aware of a tree; we can be aware of thinking about numbers, and so on. Thus it seems that in every phase of our experience, we can somehow reflect upon the experience and pronounce it ours. We may not only have the experience, but also be aware of having the experience. This possibility of reflection which represents a given experience to us as peculiarly our own is what the reference to mind poses. In this interpretation of the meaning of mind, the construct establishes a universal reference, setting up a logical relation between itself and every possible experience. It is conceivable, and I believe it is true, that this vague construct may also be endowed with organizing qualities which make for the unity of our entire experience. If this is true, mind becomes a valid construct of science, and a statement that it exists is perfectly meaningful.

But again this existence has no necessary relevance to anything substantial or material existing in space.

The story becomes even more complex when we analyze the statement that other people have consciousness. As far as my own experience is concerned it is perfectly meaningful for me to say that I am conscious, or at least that I am conscious of something. There is a direct, introspective way in which this construct of consciousness can be empirically tested. It is part of everyone's protocol plane. But when consciousness is assigned to others, the avenue of direct testing is closed. In a sense the definition of consciousness changes its first person status. It becomes a construct, takes on indirectness which deprives it of immediate significance and transfers what residue of meaning the concept retains to the manner in which it relates itself to other constructs. The consciousness of others does not enter into immediate correspondence with our P-plane under any circumstances, but the idea makes plausible why other people behave as I behave under similar conditions. The construct, while immune to direct verification, renders coherent a host of other constructs and provides logical fertility for a set that would otherwise be barren. It is only in this more circuitous sense that the consciousness of others can be maintained, and that this construct can be said to be valid or to exist.

I'm talking about science at this point, but I cannot help suggesting that the logical distance from this sort of proposition to the religious affirmation of the existence of a Deity is not very great. But it is clear from these examples that existence, even in science, is not a simple thing to comprehend or to demonstrate. The meaning of statements alleging existence, validity and truth may be very far from anything that common sense conveys.

If I had the time, I would speak about the role of intuition in science. I shall forego this opportunity except to mention that, in this part of my discourse, I shall attempt to draw a parallel between scientific intuition, the act of scientific creativity, and what is called religious or divine inspiration. I am not equating the two, but I would endeavor to show that the line between them is rather faint.

Now I turn to religion. And here I wish to be a little fuller in my explanation. I shall dismiss at once the simple argument of inferring a Designer from a design or a Creator from the creation. It has been discussed at length and I believe it does not belong in a Symposium of this sort. It is, I think, a little more cogent than Professor Nagel made it out to be, but I agree with him in concluding that it lacks complete logical rigor.

I wish to speak about the new aspects of science and their lessons relating to religion, even traditional religion. My comments so far have concerned themselves with some very general features of the scientific method. These are so general as to be applicable to almost any kind of science, ancient, classical or modern. The treatment, though induced by some contemporary developments of physical science, did not take them into explicit consideration. It behooves us, therefore, to comment briefly upon the novel aspects of physical science, especially since they facilitate the passage from the strict field of science to the less formalized domains that lie around science. These, I think, include religion.

Fifty years ago a physicist would have been amazed, indeed, dismayed and shocked, at a statement I made earlier in my talk. I said that the ultimate constituents of the physical world, like electrons, may not have definite positions at all instants of time. How can we conceive of particles without loci in space and time? Does not this claim contradict the most fundamental tenets of common sense? It does indeed, and in so far as it conflicts with common sense, common sense is in error.

I do not know what common sense is. I have searched the last twenty years for a definition. Einstein called it the layer of prejudices deposited in our mind by early inadequate teaching. I found a definition which is even more down to earth. I equate common sense with horse sense; and then I define horse sense as the good sense horses have which keeps them from betting on people.

We have learned, with some pain, perhaps, that the ultimates of nature need not have picturable attributes. This lesson is now obvious, especially when it is learned in easy stages. Common sense once thought that every object has a definite size which is independent of its state of motion. Then the theory of relativity taught us that size is not an inalienable quality of physical objects. Common sense once thought that everything existing had to have a color. Meanwhile we have become accustomed to the idea that entities smaller than a wavelength of light naturally cannot be the carriers of color. This means that atoms cannot be said to be blue, or green, or yellow or red; they simply have no color. Common sense once thought that every object, no matter how small, must occupy a definite region of space. This insistence was a generalization based upon observations made in the molar world of ordinary human experience. But clearly when an object like an electron is far too small ever to be seen, far too small ever to be grasped or to be experienced in kinesthetic or tactile fashion, the attribute of localizability may very well disappear. There is no logical difficulty in supposing that something which is too small to be seen may not have a position at all. At this

point we simply have to ignore the bidding of common sense, free ourselves of its beguilement, and proceed on the basis of logical and mathematical rules alone. When this is done, we arrive at the science of quantum mechanics, which provides a very successful set of constructs in terms of which atomic experience can be uniquely understood. The rules of quantum mechanics state that there are circumstances under which electrons cannot be credited with determinate positions in space. I am reminded of what Whitehead said about the "fallacy of simple location." He called attention to the fact that there may be existences which cannot be localized. Quantum mechanics has proved him right with respect to the particles of the atomic world.

From this and similar changes in concepts of modern atomic physics, there has resulted a freer and more tolerant view of the requirements of scientific explanation. It was only natural that the materialistic mechanist of the late nineteenth century should tie his definition of existence and reality to the hard little particles, the substances, the pellets of stuff with which his science filled the world. For him it would have been absurd to concede the reality of atoms which cannot be definitely localized in space and time; he would have been a fool to admit the reality of mind or of consciousness in defiance of the requirement of simple location. For him the questions "Where is the Mind? Where is the place of consciousness?" were entirely proper. But times have changed, and science now acknowledges as real a host of entities that cannot be described completely in mechanistic or materialistic terms. For these reasons the demands which science makes upon religion when it examines its claims to truth have become distinctly more modest; the conflict between science and religion has become less sharp, and the strain of science upon religion has been relieved. In fact a situation seems to prevail in which the theologian can seriously listen to the scientist expounding his methodology with some expectation that the latter may strike a sympathetic chord. It is not altogether out of the question that the rules of scientific methodology are now sufficiently wide and flexible to embrace some forms of religion within the scientific domain. At any rate, science has become a widely open field, and, as I see it, there are several ways in which it can adjust itself to the concerns of religion. In the following remarks, I should like to point to a few of these ways.

First, there is an approach to religion that might be called a "metascience." The open-minded and perceptive scientist, even if he has no desire to ask religious questions, cannot help but marvel at the success of his own method. As he ponders over the infinite and unruly mass of his factual experiences, and as he contrasts it with the striking simplicity and elegance of the constructional scheme whereby he is going to explain the formidable

contingencies on the data plane, he succumbs to a feeling of surprise, as though confronted with a miracle. His amazement concerns the fact that it should be possible at all for a man to comprehend so vast a domain of unorganized happenings, and to comprehend them in a manner that makes rational sense. Except for a few dyed-in-the-wool empiricists who make it their business to proclaim that this is nothing to be admired, scientists feel wonder and awe at the realization that our experiences are not a chaotic welter, but display that measure of order and consistency which expresses itself in the use of simple constructs. It is true, of course, that most scientific laws are mere approximations, but even if this is granted, it is still eminently worth notice that phenomena in the world behave with regularity. Paradoxically, amazement does not spring from the occurrence of breaches in the natural order which are often called miracles; on the contrary, it attaches to what seems to be the greatest miracle of all, namely, the lack of interruption of the natural order which expresses itself in the continuing and perhaps expanding simplicity of human explanations. The theologian Schleiermacher phrased this sentiment concerning the one supreme miracle, namely the natural order, with unforgettable beauty in his speeches to the German nation. If this sentiment be religious, science does indeed engender it.

Yet, I doubt that this form of religion, cosmic religion if you please, will satisfy the desires of the theologian. He could take it as a basis and go on from there, postulating a cause for order and a Deity to maintain it. In doing so he goes, of course, beyond the confines of science; his religion becomes what I should like to call a metascience. I see nothing in the methodology of science which forbids this; its extrapolation is from science itself. Most scientists readily admit that their methods have limits and that beyond these limits procedures controlled by other principles may well take hold.

Let me explain why I have called this a metascience and not religion. It seems proper to assume that everything that can be depicted by means of items in the diagram is comprised within the domain of science. The view in question contemplates this diagram as a whole and then seeks the cause for its structure. In doing so it necessarily transcends the diagram itself. It rises, so to speak, to dimensions from which science can be viewed in its outlines and its totality, much as theoretical science views the plane of facts. It is this transcendence out of the domain of science into a region from which science itself can be appraised that is what I meant to expose and emphasize by employing the word "metascience."

Next I will speak of religion as an enlargement of experience in the P domain, the existential domain, as it is sometimes called. Further examination of the figure leads to another interesting conjecture. That diagram is open to the left: you can go as far as you please into the domain of abstraction. The diagram is closed by the P-plane on the right. A given protocol phenomenon can be explained by a series of steps to the left that apparently has no end. Thus, for example, in answering the question "Why does an object fall near the surface of the earth?", one may refer to Galilean theory of free fall which says merely that all bodies fall with equal and constant acceleration. This takes us to a set of constructs not far removed from the P-plane. But this law of free fall is nothing more than a special instance of universal gravitation, which, in our symbolic sense, lies a greater distance away from the P-plane. Again, we need not stop there. It is possible to view the theory of universal gravitation as a special case of the theory of general relativity. We have thus taken a third step back to the left, away from the P-plane. To be sure, with the present state of science, we must stop here. However, there is nothing to block further progress into the more abstract. Indeed, if the past development of science allows a prediction, it is that we shall someday find an even more general theory in terms of which the law of Einstein and others can be jointly comprehended. No limit seems to be set to man's progress to the left in the C-field. But as we reverse this procedure, going from the general to the more particular, we end in our protocol plane. We conclude by saying that the stone simply falls. This is a brute fact, grotesque, final, and meaningless.

The question has often been asked in the history of philosophy as follows: "If the P-plane limits experience, is there anything beyond experience?" I would find that, if science is limited to experience, the answer, which is affirmative, transcends science. But I doubt that it necessarily involves religion. What lies beyond may be the Kantian thing in itself, that essence which, being no part of experience, is never knowable. Or there may be some mystical kind of non-scientific reality which, lying beyond experience, can never be fathomed. If it is thought that the divine lies beyond the P-plane, that divine, since it excludes the possibility of experience, is not likely to interest the theologian or the scientist.

But the closure of the field of experience raises still another question. Perhaps it arises from the circumstance that in our entire epistemology we have limited ourselves to vehicles which are rational procedures. We have used induction and deduction in traveling back and forth through the domain of the figure. Could it not be that, in order to prove the fullness of what is actually present in or near the P-plane, we are required to abandon reason and give ourselves whole-heartedly and without

withstraint to basking in the sensation of the immediately given? The fundamental essence of the ebb and flow of sensation, the richness of the immediacy of our direct experience, the metaphysical substance of what assails our being in the act of sensation and affection, may after all escape the myth of rational analysis. This is the view of the existentialist, that greater emphasis upon the purely existential, the contingent and spontaneous feature of our total experience is necessary. There is no doubt that the Hindu seer and the Christian mystic feel the immediate presence of God in the exposure to the immediate.

Some philosophers of this school, notably Heidegger, go so far as to claim that the scientific process, in mapping the P-plane upon constructs, actually falsifies experience, and that only conscious and detached attention to immediacy will undo the damage of science. "Sein" or being, which is largely identical with our P-plane experience, is said to be the center of interest of enlightened man. To capture it by scientific means is to violate it, to set traps for it, and in the process of capture the scientist injures or kills "being." Thus, what the scientist finally comes to hold is not truth or being, but the corpse of truth. Existentialistic analysis, on the other hand, claims to stalk being like rare game and to watch it without disturbing it. For only in its natural setting can one comprehend the essence of being without degrading it.

I think it is true that science, particularly modern science, by its coldly logical and analytic attitude, and, what is more, by its frequent disregard of philosophic questions, has stimulated the reactionary view I have just mentioned. Despite its many faults, despite its anti-intellectual flavor which I deplore, this view has nevertheless the virtue of calling attention to a few limitations which the method of science clearly should acknowledge. For there are questions which science with its present methodology probably will never answer; the full drama of existence cannot be enacted on the stage of science with its contemporary setting. Questions like those raised by Kierkegaard and Heidegger, questions like "Why am I? Why is there anything at all? Why the phenomena of experience?" appear as idle vaporings when viewed as problems of science. Yet they bespeak an intense human concern and contain a powerful appeal that defies the positivistic insistence that they are meaningless or insignificant. If science does not answer them, is it not reasonable that at this point we resign ourselves to other hands? This is indeed affirmed by those who see religion as an extension of experience into the existential domain. They feel that the P-plane must somehow be opened up by a new kind of analysis, an analysis not scientific, an analysis for which science offers no help. What happens when this extension is permitted can hardly be predicted in detail. One can go the way of Sartre and dwell in

non-religious fashion upon the nausea of existence. Or one can go the way of Kierkegaard and Marcel and couple the existential affirmation with an excursion into the domain of religion. At any rate the P-plane quite obviously is an area of contact between science and religion, as the wide spread acceptance of existentialist philosophy today clearly shows.

I come to my last item, in which I shall attempt to describe religion as a part of an enlarged science. My fondest hope lies in the direction of amalgamating science with religion, not in the sense in which Dr. Rabi portrayed the conflict, as a civil war, but rather as two processes going on along parallel lines. It is by no means out of the question that a theory of religion, that is to say a theology, when fully developed, may exhibit the same form of structure as science itself. A suggestion affirming such conjectures is already present in the writings of William James, who regards the body of religious beliefs as a doctrine capable of pragmatic verification. He is vague, to be sure, when discussing the precise manner in which such beliefs are to be tested, but the general idea is certainly there.

If such an approach is to be started, the first question to be answered is: "What is the P-plane, the protocol plane, of religion?" A possible and probably correct answer appears to be this: the kind of immediate experience which is often regarded as distinctively religious. I mean such things as the feeling of gratitude for our human existence, mystical communion with the infinite, the sense of the eternal, despair at the prospect of irrevocable annihilation, the inexplicable feeling of the relevance of an occasion which the saints describe as an encounter with the Holy, our frightened encounter with the tremendum. To say that these are peculiarly religious experiences is not to argue that they are exclusively religious. For they are also P-facts for several of the so-called social sciences, "and I hate to suggest that psychology, psychiatry, sociology and anthropology should not be concerned with them and endeavor to show how they can be organized in the constructional schemes of those sciences." This, however, does not cast out the possibility of an analysis in religious terms, nor does it show such an analysis to be illegitimate. For a given simple sensation may very well be the starting point of several inquiries, one into the physical, the others into biological or psychological domains of construct. The fact that a given experience can be a P-datum for a variety of sciences must always be recognized, and is no argument whatever against the validity of the various explanatory schemes. And in this context religion, too, can claim its due. If I see yellow light, as a physicist I jump from that protocol fact to the construct: wavelength of 5600 Angstrom units. The psychologist would immediately think of stimulus and response.

The artist who is not a scientist will again have a different reaction. Now, there is nothing wrong with these different reactions, and they are not contradictory, but they do seem incompatible at the present time. However, there is a hope that, as science progresses, it will see them in synthesis, in a common light. This, at any rate, is a hope of most scientists.

What follows next in the development of a "science" of religion is a little difficult to predict, though probably not more difficult than it would have been to forecast the structure of modern science in Aristotle's day. Sciences grow when people become convinced of their importance and necessity, and they develop their methodology as they mature. There are those who believe that theology already provides a C-field in terms of which a logical synthesis among the experiences I have named can be achieved. If this is to be accepted, the ideas of theology must be subjected to the same metaphysical requirements which we impose on scientific theories: logical fertility, extensibility, multiple connections, causality, elegance, simplicity, and several others. It must partake of all these qualities in order to be acceptable; nor is this often denied by workers in the field.

Moreover, if religion is to have the structure of science, it must also expose itself to tests in the manner of circuits with empirical verification. This forces us to reject at once certain peculiar kinds of theology such as predetermination of the Calvinistic type. Any test which man could devise would be foreordained, would have been included in the creator's foresight at the very beginning. It would, therefore, be futile to regard the outcome of the test as significant. But such criticisms do not affect most major theological systems.

You see, natural science is not wholly without suggestions as to the structure of a religion based on the grounds of its own methodology. But it offers no detailed material aid. Least of all does it require the slavish adherence of theological doctrine to the constructs of physics, chemistry or biology. This does not imply contrast or contradiction. For surely, if a concept applicable in one field has no application in another, it does not contradict it; the notion of temperature is entirely in harmony with that of an atom, although it has no relevance for a single atom. You cannot ascribe a temperature to an atom, yet an aggregate of atoms can have a temperature. It is this methodological structure of science that might be transferable. As you see, I do not advocate "physicalism" in religion.

In concluding, may I say that I have kept this discourse deliberately on a general methodological plane. There are many holes that need to be filled in, and many touches of personal

belief should be added, but I thought they had better be reserved to the less formal discussion, where they can be elicited by specific questions.

FLOOR - You leave room for religion after the conclusions of science have been worked out. There is a natural beauty. Scientists are in awe of it. Perhaps we shall find universal order, a cosmic order, and, as relativity can explain the falling of a rock, so this order may also explain all of the things in the C-field. However, you said that this must be subjected to the same criteria to which we subject the conclusions of science. Professor Nagel has said, and you, I believe, agreed with him, that religion has not been able to show an order in the world which correctly explains all the facts in the C-field. So you would seem to be excluding from religion all the theology and dogma and leaving only existentialism.

DR. MARGENAU - When I sketched my argument from order in the world, I kept my exposition far too brief. I know it has many adherents, many proponents; however, it cannot produce a measure of cogency, the logical force, which science requires. Therefore, I would regard it as a rather rudimentary form of religion, certainly as lacking persuasive power. With respect to the existential component of religion and the immediacy of human experience, I said it is a form of religion which I cannot fully appreciate. It is followed by many more people in the Orient than in the West. It is not a scientific form of religion. The only truly scientific form is the last one I sketched: that which proceeds from an unorganized set of immediate religious experiences, such as those I've named, and goes from there to a rational set of constructs, to a system of thought which one might call theology; from ideas such as salvation, divine grace, and God. If it does that, I would say, then certain consequences must flow from it. It must be possible to go from the assumption back to immediate experience and "predict" it in a way, not necessarily the same as that practiced by physical science, but certainly in a way that must generate its own manner of verification, its own manner of persuasiveness, its own conviction. This was the point I made. This kind of religion has not yet been achieved, but I think many people are on their way to building it.

FLOOR - You touched upon the duality of the electron. I wonder if you would be willing as a philosopher of science to comment for a moment on whether or not this duality - rather than being the beguilement of common sense - is truly a conceptual conflict? In this way does it not illustrate a change in the methodology of science?

DR. MARGENAU - I wanted to convey to you an idea which is present in everyone's mind without discrimination, without raising issues such as the one which you have now raised. In my opinion there is no duality, there is no dualism in the nature of the electron at all. The question "Is the electron a particle or a wave?" can be answered in three ways. First, we can say it is both a particle and a wave; we have many bits of evidence to show that this is false. Second, we can say that it is sometimes a particle, sometimes a wave, i.e., it acts like a chameleon which changes not only its color but also its nature; that is complete nonsense. The correct answer is that it is neither a particle nor a wave; it is something that is more abstract than either of these things - thou shalt not make thyself a graven image, you know. It is something which defies picturability, and so the dualism is out. I believe that the things that occur in nature are as unique and as clear as ever; however, they cannot be conceived any longer in simple visual terms. The models which we used to understand them have broken down. We need the freer air of mathematical and logical abstraction in describing their nature. So the dualism is out, and the change in physical methodology which has occurred is not one of acknowledging lack of uniqueness in the essence of physical things, as dualism would imply. It is simply the passage from a system in which all explanations are couched in mechanistic, visual terms, to a system in which common sense has been abandoned and free logical creation is given full rein.

FLOOR - The erudition of your talk has brought to mind so many points. I would like to go back to the diagram because I feel it is the core of what you've had to say. It seems to be expandable as far as one goes, even into the sphere of religion as you have carried it, that is out to the left. My question centers on the P-plane, which is a new concept for me, and one which I haven't seen before. The P-plane is connected to the C-field by the parallel lines, which I believe you referred to as quantification or measurement, and this is what encloses this system on P-plane and enables you now to generate it out to the left. You used the word "science" all the way through your talk in the sense of natural science, and eventually you talked about psychology.

My question really refers to looking at the body from another point of view. I don't experience, as a psychologist, my retina. I would question whether there is a stimulus and eye response; I don't think that's a correct psychological statement. I think we need a metaphysic of the body, and if the parallel lines of measurement are not applicable, then this does not come within the confines of your all-embracing structure of the logic of science. In other words perhaps the P-plane can be two things.

DR. MARGENAU - No, the P experience is unique, but the passage from the P experience into the explanatory domain can occur in many ways.

FLOOR - Yes, but the essential links are those parallel lines, and if the P-plane is approached essentially from a point of view that does not permit understanding it, then it would seem to me that there is room in this universe for another methodology beyond the one that you have explicated. Whether or not it would handle religion I cannot say, but it would seem to me that this is not one all-embracing structure which will handle the totality of human experiences.

DR. MARGENAU - I limited it to two kinds of experience, but I did not describe it for you. The question you asked is indeed justified; I stand guilty of having given insufficient explanation. The explanation is long and I don't think I can do your question justice in the few minutes that remain. Let me merely say this. The P-plane, the protocol plane, designates all those things to which any science finally has recourse, for example, that which you think to be indubitable in science, the observations which you do not doubt as having been made, the numbers your apparatus gives you, and the things you see immediately, etc. It corresponds more or less to the old style "perception," if you please, or apprehension. The best way to approach science is as an exercise in the analysis of your own experience. Let's agree that all our experiences initially are first person experiences. Now some of that first person experience is coercive, it is contingent. The data you take, the responses of your subject, these are P facts which you do not alter, but which you must explain.

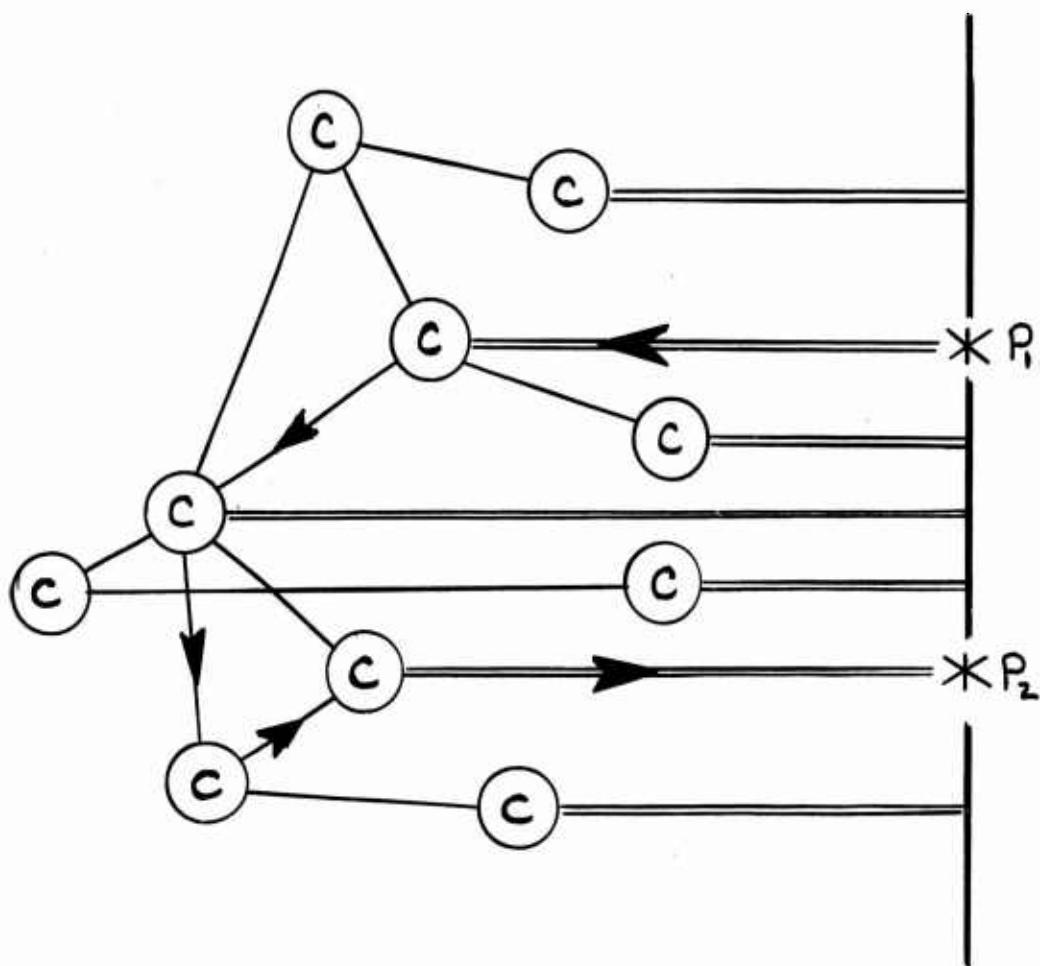
Every P fact requires a rationale. I gave an example of the measurement of, and the experience of, temperature - the P experience of temperature, what you feel in your fingertip when you stick it in a hot bath of water. That is not temperature P, the number that goes into the equation of thermodynamics. It's something else. What you do then is to pass from that P, protocol, immediate thermal sensation, temperature sensation in your fingertip, to the number you read on a thermometer. That number is a construct, it has become objective, free from the subjectivity which made it relative to your own previous experience, previous exposure of your fingertip and so forth. Now you see that is one passage from P to C - the human body is not itself part of our P experience. You don't know that you have a human body to begin with; what you know is that you have sensations of and in a human body. From the manifold of sensations you conclude that you have a body. That is to say, the body is not as immediately given as your sensations are. This is the point I'm making.

FLOOR - I reject absolutely your last statement. The body that you have from your description is a body that is based on the concept of physics, and psychology in this country is precisely physics. That is precisely what's wrong with it. I was hoping that you would come around to see the other side of that P-plane.

DR. MARGENAU - I would say that the human body is not as directly given as your sensations of it. The human body is not a sensation. It is a construct made out of sensations. It is the same with the table before me. The table is not merely the sum of all sensations I have of it. The table also has other properties which are not sensed, such as self-identity. It is there when I am not looking, and so forth.

THE P-PLANE AND C-FIELD

The vertical line is a section of the P-, or protocol, plane, which represents immediate, unorganized sense experience. The C-, or construct, field contains the logical models which we use to order the protocol facts. The arrows show a circuit of empirical confirmation of the theories in the C-field. We begin with a step from datum P_1 to its corresponding construct. After a series of logical steps in the C-field, we return, by way of prediction, to datum P_2 for verification of our model of reality.



PANEL DISCUSSION

MAJOR DUNN - I would like to open our session today by introducing the three new members on our panel. The first one is Professor Lehmann. He is Professor of Physics and also assistant Dean for Research at the Air Force Institute of Technology. He has been very active in the Episcopal Church, and so he represents the protestant view. Next to him is Professor Sarkar who is a visiting Professor of Philosophy at the University of New Mexico. He is a practicing Hindu. And, finally, let me introduce Father Clarke, a Roman Catholic Priest in the Jesuit Order who is an associate professor of Philosophy at Fordham University. He is the editor-in-chief of the International Philosophical Quarterly and his specialties include metaphysics and the philosophy of God.

Now I would like to ask each of our new panel members to make an opening statement. At the conclusion of these statements I would like to limit the questioning to individuals within the panel. I have a number of questions which were turned in yesterday and we have tried to go over these to consolidate them into a few categories. I will interject these at points in the discussion where it seems appropriate. With those brief remarks I would like to ask Professor Lehmann to make an opening statement.

DR. LEHMANN - Yesterday morning, when Col Gilbert had us all in his office, he told us a story. He told us about a cartoon with a picture of a bunch of people running in some direction and one person running after them. The caption said, "I must catch up with those people for I am their leader." Well, you know, I feel the same way. There's a group of men here who were my students and I feel that all through my life I have been chasing after them. I must catch up with them for I am their teacher! Yesterday there were some tremendous descriptions and discussions on all the various points of this Symposium. I start thinking - what the hell can I add that's new? I came up with nothing. So, I'm going to take a blackboard and call it the way I see it. This is a personal observation. Many of the things will be repeats, and some of the ideas have come up before. But, I do have some convictions on this, and rather than trying to bring them out in questions, I would like to put them on the board.

The first thing I want to discuss is the idea of communications. People get ideas. They get ideas by experience, through the creative mind, by association, by conversations and by sharing their lives with other people. If you want to communicate these

ideas a man has to first conceive them, he has to put them into words, and these words have to be heard by somebody else, by the listener, and understood. You can substitute writing for listening if you want to use that medium. And, there is room for misunderstanding, a message can get garbled between the mind of the conceiver and the understanding of the hearer. That's one point I want to make.

I want to make a second point. We're talking about three disciplines, science, philosophy, and religion. I think that ethics comes out of these. It may be the result of one, two, or all three or more of these, but ethics is derivative. I call these the fundamentals. The characteristic of science is that you have precise definitions, operations, and reasoning. And with this precision of definitions, operations and reasoning one scientist in one part of the world can communicate accurately with another scientist in another part of the world. They can agree on definitions, they can agree on reasoning, they can agree on operations and they can compare results. Through this kind of method science has made tremendous advances. Let me mention philosophy. I never took a course in philosophy and I don't know much about it, but let me just say philosophy is reasoning. I'm going to lump philosophy with science. In philosophy you can get agreement between different people on the ground rules. In principle then, philosophy is very much like science. On the other hand, religion is much more difficult to pin down. Words like love, God, divine, life-everlasting, present problems. I have never seen a precise definition of any of these terms. I don't think you ever will find precise definitions of these terms. But, I believe fully that these terms are as real as anything in the other two fields. Love for instance, you either love your wife or you do not. You have either experienced it or you haven't and if you haven't you're much the poorer. Billions of words must have been written on the meaning of God but it hasn't been defined. A man can have a clear idea and if words come out and they say something you still have no way of knowing whether it's the same as the hearer or not. There is an area of uncertainty here.

I would state that I am a Christian and I want to confine my comments to that religion. I know other religions have things common to Christianity. Jesus Christ never came into the world and said - I am going to prove to you that I am the Light and I am the Way. He never said that I am going to prove that you should love thy neighbor as thyself. He offered these as elements of faith. Mortimer Adler called this revealed knowledge. Either you know it or you don't. It's a matter of faith. I tried to go through rationalization in my own life

in an attempt to understand and it never amounted to a hill of beans. I think a man comes to a point where you accept it as a matter of faith or you don't. It's that simple, that arbitrary. Also, I think it's wrong to ask that science answer the questions of religion. And, it's wrong to ask religion to answer the questions of science. The one thing that these three have in common is that they all have an agent, man. Some men have experiences in all these areas, some in only a few. Perhaps science will be able to answer some of the unanswered questions of religion in the future. I doubt that it will ever answer all of them. Any man may experience one or more of these and one or more of these may take the place of religion. A man may incorporate all of them. I think this is a matter of individual development, individual experience.

MAJOR DUNN - Thank you very much Professor Lehmann. Next I would like to ask Professor Sarkar if he would say a few words.

PROFESSOR SARKAR - I do not have very much to say but since it was reported here that I am living a Hindu life I would very much like to explain my position. We want to live, and live with some kind of experience. My experience is, as I understand it, science, philosophy, religion, ethics, logic, and psychology. But, since I am just a person with common sense, I will not specialize into those studies. I would not like to define them; because, when I live, I take note of all aspects of experience. I feel that our present life, which in the aspects you would call apparent, is distinct from the kinds of life that we have to realize. In the western civilization we find stresses given to a variety of consciences; but, people in India, from the very ancient times, became conscious of other aspects of life, such as dreams, or deep sleep. Now, these we think will be admitted as experience by each person; because deep sleep, which the western people have not thought of very much, is part of that experience and has to be noted. We cannot exclude any aspect as fetish. I will not interpret experience like the psychologists do and try to differentiate dream from waking experience. My view of understanding experience is just a coming and going. None of these experiences are stable, they're all transient. Now, when I view this transience I am reminded of something basic. I raise the question, is there any foundational experience which has to be known? If there is not, I feel diffidence in living in a world which is apparently transient. And, I also feel that unless there is such an experience I will not have any faith in religion, philosophy, or even in science. Because without some sort of foundational experience, the experience that comes and goes has no meaning. One should know whether there is a foundational experience in the apparent order of

experience. The latter appears to be material, vital, and mental, and I would add to this the intellectual and blissful. By my reflection, I find that that which stabilizes my so-called apparent experiences of wisdom, dream and deep sleep, is the same as the experience that I find behind the apparent processes of nature when analyzed as the material, vital, mental, intellectual, and blissful. I find the same satisfaction in these two orders of experience. One may be inner and the other outer, but, I find these nonrelative in that kind of experience. So, I come by that kind of experience by way of concentration. In the same light I find the idea of science, religion, and philosophy not what we empirically understand it to be in this world of ours.

Now, taking that as the foundation, I also believe that that experience which is foundational may not necessarily be understood in terms of any specific notion of self or of God. I feel that that is some kind of reality that we must all form whether we are a scientist, philosopher, or a man of religion. I think any psychologist or any person who is deeply concerned with his own existence and life should take for granted such basic experience. Now, this leads me to think that the present life of ours is not the end of things. There is a past, otherwise I could not have come into this existence as the present, and there is a future. Now, that reflectively follows because the present life cannot be the end. There is a psychological continuity, a cosmic continuity. And, this continuity may not be understood in terms of any specific consciousness. Still, I think the scientists will not deny that there is such a continuity. Now, if that be so, I am led to the supposition of the possibility of future lives. I think that this has been the fundamental position of certain rationalist religions. Belief in the present existence, belief in the life previous or belief in the life hereafter, is understanding a sense of responsibility so that we cannot act whimsically. That really can be a model existence. And, mankind will have to respect the modern rules, not only of one nation, or of one country, but of all countries and of all cultures. I think all humanity might meet here. In what I have suggested men of religion will agree, though such a faith might not necessarily lead one to a belief in one God.

I would like to completely free myself from any cultural notion of religion associated with the idea of God. But, let me say that I am still a religious person, a modern person, deeply psychological, and with some kind of scientific notion. My view is that religion, philosophy, and science, are one united, nondifferential experience that one should try to

realize in one's life. I think that is the Hindu view of life and the one that I would like to present to you all.

MAJOR DUNN - I would now like to ask Father Clarke if he would like to say a few words.

FATHER CLARKE - One of the many reasons why I came down here was to test out a hypothesis about the Air Force. Educators are very much interested, and rather proud, of the Air Force because of their policy of trying to give their men a broader education and a broader outlook than the technical or specialized one. The opening talk of Col Gilbert confirmed this. The whole symposium confirms this. I would like to present briefly what I think are the basic principles behind this thinking, this educating of a person in terms of a broader context. Why do you speak of somebody as having a broader outlook than someone else, as not being narrow? It seems obvious that it is because he has broader horizons. And, because he sees the particular thing he's doing in terms of wider context. The broader this person is, the wider are the horizons into which he situates his particular activity. Now, if you wish to carry this all the way, if a person is going to be living up to the full breadth and depth of his human nature then he must extend his context or his horizons all the way until they reach what I would call totality. That is, reach some kind of ultimate horizons. Within this view one could define a person or define the knowledge of oneself as a person. At least one could give a partial definition. An essential part of defining oneself as a person is to know oneself as a whole, in the whole, and situated in the total context of all reality. When we look into the nature of these great totalities we find that they are few in number. There is first of all the self, the person, the I. That's a kind of totality. It's not myself as a scientist, or as a father, or any of these particular things. It's myself as a person, that's a totality. That's a kind of limit. Then, a second totality is the whole material cosmos or universe in which man is. On the first level of the person, one should expand that I as a person into a community of persons. So, the self in the light of all other conscious selves is one totality. A third totality, the ultimate totality one might say, would be God. And, if one believes in God, this is the source of the entire being. One could totalize all of these totalities into simple reality itself. The totality of being or reality. Now, in order to understand oneself fully as a person, one must push one's thinking all the way in these totalities. One must do what I would call totalistic thinking. Thinking in terms of wholes and not just of parts. Not to do this is to surrender to the fascination of the part and lose the vision of the whole. And, this is a tragedy or stunting of the whole person. Now, the kind of thinking that reaches

wholes and reflects on them, and draws conclusions from them, is the kind of thinking specific to philosophy, religion, and theology. Theology tries to make an ordered system out of religion. Philosophy and religion try to think in terms of the ultimate. And, it seems to me that science is totally incapable, in principle, of doing this kind of totalistic thinking.

Some of the questions asked in our discussions here have been to the effect - wouldn't it be possible, someday, for science to develop so far that it could possibly replace religion or philosophy? I would say that science is presently incapable of doing anything like that. Because, in principle it is incapable of doing totalistic thinking. It always operates inside the whole in terms of some specific determinate part which can be tested in some observable, empirical way. By its very method therefore, it's condemned to exploring the part. There is no possible way, with its present methods and aims, for it to consider wholes. It always has to start with a whole, as given, and then operate inside some part. It helps us to understand the internal working of the universe, and the material universe especially. It tells us how it works. Whereas philosophy and theology would ask - not how does the universe work, but, how is it that there is a universe at all and what is the purpose of me as a total person. Let me put this in terms of your own ideal in the Air Force. You must see your present scientific work in the whole if you want to be a full person. You must see your work in wider contexts. First you must see yourself as a whole person, then, this whole person in the totality. You really have to go on to do that. I think it's pretty clear in modern thinking that you can't understand the part except in relation to the whole. The notion of system is essential to modern thinking on all levels. The part is understood by its place in the system. The very work you're doing here is just one of the intellectual activities of man. So that to understand what you're doing here you have to expand your thinking beyond the immediate context of your science, your physics, your Weapons Laboratory, and even the Air Force itself. This should be of some help when you look for this goal.

Yesterday, Professor Margenau hit precisely on this type of thinking. When talking about his diagram, he asked you to consider the diagram as a whole of the experience level and once you consider the diagram as a whole, you then transcend the diagram and go outside of science. This puts you in metascience. I would call that more philosophy. Since religion would go much further into a personal relation with the source, the author of all being, my beginning and my end.

But as soon as one does wholistic thinking one is outside science. So, I would like to set up that structure for the total person.

Let me say that if one asks, in the light of Professor Nagel's paper, is it possible to get evidence about the existence of God, or any of these deeper things from the scientific method as we know it today, I would say it's impossible. One has to adopt a different method of thinking which is wholistic. How does one do that? There are technical ways of doing it. There are also very simple non-technical, human ways of doing it. Very simple people can do this wholistic thinking. They can do it by a turning inside to reflection. They might, by this, arrive at God, or a something some would call the God hypothesis. This is the only hypothesis, one that gives total meaning in my life as a total person in the context of the whole universe. It's concerned therefore, with the actual existence of the universe and of myself. This would be my statement about the structure of our growth as people. Thank you.

MAJOR DUNN - I would now like to open the program to questions within the panel. May I remind the panel that we are taping these proceedings so we would like to ask you to talk one at a time so that we can get everything. Do we have any opening questions?

DR. NAGEL - I'm not sure to whom my question is addressed among my colleagues, but I think that the question is relevant to what has been said by a number of speakers. Let me put it very specifically in terms of Father Henle's suggestion that there are alternative or different methods of acquiring knowledge and that we have an option between them and that we have to decide between them. My question is - if you make a decision between alternatives using some method or procedure in evaluating or assessing these, what sort of method is it that you are using? Does it coincide with one of the several alternatives that you think are available to us or is it something utterly different, what is the character of this general procedure for deciding between alternatives? I raised the question in this way, but let me indicate what some of the consequences of the question are. And, let me again turn to a specific point that was just made by Father Clarke. He maintains that there is something that he calls wholistic thinking, which science itself is incapable of. Now, I'm very much puzzled by this. I don't deny that we can make a distinction between

thinking of, or being concerned with, a relatively small problem and a more inclusive one. But, this is something that a scientist himself can do and I don't know what the characteristics of this wholistic method or wholistic thinking is that differentiates it from what we normally call the method of rational reflection. In rational reflection one engages in considering what the consequences of certain assumptions are and what the difficulties with it are. People talk about the scientific method as being something that is very unique and distinctive which has very definite limitations. It may very well be that it has very serious limitations. If you limit the notion of what the method of science is and if you think that the method of science consists simply in doing experiments and using the experimental results to confirm hypothesis, then, of course, it's perfectly true that there are many areas of inquiry where the scientific method, in this special sense, doesn't apply. For instance, in mathematics one doesn't perform experiments. But to say that the kind of thinking one does in mathematics is different from the kind of thinking that one does in science seems to me to be entirely false. Mathematical thought is part of what one normally calls the procedures of science. I don't want to take all the time that's available to us, but let me repeat my question, which I think is so central in our discussion. I challenge the supposition that there are methods of establishing claims to knowledge which are in some radical sense different from the method of reflective thought. What the character of this method is and what it's authority is I would be very much indebted to anyone who could provide some illumination.

MAJOR DUNN - Thank you very much. Do we have an answer?

FATHER HENLE - The difficulty in answering this question is that I feel certain that whatever terminology I use quite briefly, or whatever formula I would propose by which to describe some of these things that you've asked me to describe, would take me so long to explain that we'd still be here next year for the next conference. This is one of the problems of this type of discussion and therefore I'm not going to attempt to do that, but, I will merely state the differences which exist and suggest that there is a whole body of literature that deals with this and a whole systematic treatment to the position from which I'm speaking. Yesterday I proposed some of this merely in a problematical form. And, I said that there were alternate ways of approaching reality and alternate ways of understanding it, and we have to make options among them. I was not saying that the final solution was with one

method or one discipline alone. There are people in the world who have taken this position and they are pushing one discipline or one group of disciplines. They may even use this as the definition of rational reflective thought. I think you, Professor Nagel, have done this. You have done an excellent analysis of the structure and logic of science. I'm not confident that you have done a complete epistemological analysis of the type of concept used in science. But, as far as the logic of science goes, the stating of a hypothesis, testing consequences, and the structure of explanation, I think you've done an excellent job. And, by the same token, I think your analysis is limited to the kinds of things that you have analyzed. This puts your system in my spectrum of methods and within a limited range of methodology it works very well. The ambivalent problem here is that anyone who makes selection out of the spectrum tends to present it as the total explanation of all kinds of rational thinking.

So, coming back to a simple statement of position, I would agree that, within the spectrum of methodology and within the realm of types of explanation, the kind of analysis that you have done is excellent. But, I think that there are other methods. The philosophical method does not fall under the analysis you have made and it would require a book, equal in size to the one you have produced, to do a fair analysis of the philosophical method. I think it exists in the literature and it's a position which is highly respectable, at least in terms of the people who are supporting it. These are people other than myself. I can't reproduce that book here and now. I would like to make one other point. When you are doing the epistemology of various methodologies is it not obvious that you've got to find one that can transcend the limits either of a given methodology or of all methodologies. And, to use Father Clarke's terminology, which is not wholly congenial to my approach, we should talk about wholistic thinking. What you should find is a wholistic base to epistemology before you differentiate it into the various disciplines which make up the history of culture. One of the points where you and I would have trouble is that your approach to the analysis of methodology is to the logical structure of the method. I see this as, perhaps, the least important part of epistemology. The conceptual formation, the type of concept, and the inter-relationship of the concept is a much more specific and relevant area in which we can make the differentiation. Consequently, if you deal with logical structure in a very generalized sense, I would agree that a syllogism in philosophy, a syllogism in physics, and a syllogism in mathematics will look very much alike logically. But, if you put them in the

context of a conceptual formation then the direction of the thought becomes quite a different thing. I would disagree with you when you said that mathematics has the same kind of methodology, epistemologically speaking as science has. Mathematics is a part of science, and it stands as an instrumentation within science. But, it stands in its own right, and I do not accept the view that mathematics is merely a language for expressing other entities. I think mathematics is a discipline in its own right and it has a conceptual kind of methodology peculiar to itself. You don't use it in philosophy and you don't use it in art. In my spectrum mathematics would be a different discipline, methodologically different from the kind of discipline that you have in a range of what we today call the sciences. For instance, physics and chemistry. We should draw the line somewhere in the middle of the social sciences to differentiate some of the philosophical approaches to the sciences. I'm afraid that in this short time about all I can do is dogmatically state that this is my position. I invite anyone who's interested to write to me for a free bibliography.

PROFESSOR NAGEL - Father Henle, wouldn't you regard Spinoza's philosophical system as an example of the kind of, using Father Clarke's language not yours, wholistic thinking that you spoke about? If Spinoza isn't entirely congenial would St. Thomas be a reasonable example? Now, it seems to me that if you say yes, then I've got you by a wet stick. Because, as I read Spinoza he makes assumptions, he draws consequences and he interrelates concepts. Now, to be sure, the subject matter is different from Newton's, but, the intellectual methods seem to be the same. And, although I'm not a profound student of St. Thomas, I read him with tremendous interest and admiration for what he does. He raises questions, indicates what the difficulty is, suggests one type of answer, gives a catalog of difficulties, resolves them, and then comes to a conclusion. This seems to be a reflective method that I find no different from the one you use in number theory. Number theorems may never be applicable to any domain of empirical research, but, the procedure seems to be the same. And, although I agree there is a tremendous literature in epistemology, and I'm familiar with some of this, I have never been convinced of the distinct methods.

FATHER HENLE - There are a couple of different questions here. First of all, let me speak about Spinoza. Is this a wholistic approach? It is definitely. This is one reason why I don't think wholistic thinking is an adequate distinctive mark of philosophical thinking, because, Spinoza is not in physics. He's not doing physics, mechanics, or chemistry, what he's trying to do is philosophy. He's making an effort to give a

wholistic presentation. I think Spinoza falls down, and here I would argue with him, in the methodology he has adopted. He's in the 17th Century wave of worshiping the application of mathematics to all known problems. And, he, like a lot of other people, think that the best thing to do is what Galileo and other people have done. Descartes applied mathematics to philosophical principles and put the thing in the framework of a geometrical presentation. Here I'm using geometry in the Greek sense. Now, this raises the problem as to whether he really is doing this geometrically. This I seriously doubt. Then, if he's not doing it geometrically what kind of method is it? No doubt he's got a very elaborate description of what he considers to be philosophical methodology, and I would say that it is not anything like your description of scientific methodology. So that this isn't a yes or no answer to that question.

When you look at the methodology of St. Thomas and when you examine its logical structure it looks like any other type of thinking. But, the point I want to make is that you should not look at the structure of the question but look at St. Thomas' epistemology with regard to the organization of concepts and the nature of explanation. When you do this, you will find something quite different from what you have analyzed in the sciences.

PROFESSOR MARGENAU - If it's appropriate, I would like to present a view which might mediate between these two rather strong extremes with respect to the meanings of scientific method. I would like to touch all three of these questions. First the one concerning the limitation of the scientific method and whether the scientific method is indeed different from the philosophic method. Second, I would like to speak a little more precisely about the relation between mathematics and exact science. Finally, I should like to speak about the relation between science and philosophy. Are they different? Do they cohabit or do they entail one another? Let me approach the problems of the limitation of science and of the meaning of the scientific method, within the context of human experience, in a somewhat devious way.

Science often is represented as being a bunch of facts, a catalog of human knowledge which is certified to be true. The simile used in this connection would be the picture puzzle. The scientist is said to go around the world turning over rocks to see what's under them, finding facts, bugs, and what not. He, in other words, finds small facets of truth called facts. Somehow these facts are constituted by nature, or the creator, they then fit together in a pattern. And, when the scientist puts them together in the right way he will get that pattern and then his problem is solved. This is the picture puzzle view of science.

I think it is dead wrong, because in the first place it describes inadequately what the scientist does. The scientific problem is never complete. Whenever you solve a scientific problem there are ten others which rear, not their ugly but their beautiful heads, behind it and this is the challenge of scientific research. Secondly, the picture suggests that science moves on a two-dimensional plane. It puts one fact along side of another. This is not at all what science does. This produces no integration within the sciences, not even within a single science. In order to understand rather than gain factual knowledge you've got to go below the surface of the facts. The word understand suggests this very beautifully. There's a third dimension beneath the facts where the theories are. Here lies the principles that unify the facts and provide an understanding which transcends knowledge. I would like to replace this picture puzzle analogy by another, the picture of a crystal which is growing. Some of you may have seen this demonstration which is given by many elementary school teachers of physics. They place a certain liquid into a vessel with transparent flat walls, put it between two polaroids, shine light through it, and watch the results on a screen. You see random bits of fluid moving in a chaotic, an interestingly beautiful fashion, but in a manner that does not tolerate scientific description, that displays no regularity whatever. Now, suddenly when the temperature drops below the melting point something happens. Here and there a needle begins to form and grow. Now the crystal stretches a long arm in one direction, one in another, and its movement is unrestricted except insofar as there are container walls. Now, it seems to me, that what happens here in this liquid is rather symbolic of what happens to human experience before it is organized by scientific investigation and reasoning. Scientific knowledge is just like the liquid in which the crystal formed. Remember that when the crystal forms it leaves the substance of the liquid unaltered. The chemistry has not been changed a bit. A measure of regularity has been imposed upon the chaos of the liquid. And, you get a crystal lattice with symmetry and beauty. Now, the same thing happens in human experience when the scientific 'crystal', the scientific idea, appears and grows. It will grow in the manner of the crystal, that is unregulated. It's very difficult to say where science is going to go next. Science stretches an organizing arm here, a broad one there. Or, you can help by putting in money. There are many analogues although the analogy is not complete.

The domain of human experience which has been thus organized by the scientific method (I haven't yet described it in detail, I gave a few indications of what my own conception of it would be on the blackboard yesterday) will

never comprise the whole of human affairs, the whole of human interest or the whole of human concern. At times there will rise from the furtive ground of being, new essential facts. Things will come into our knowledge which science has not dealt with and possibly never will. The point is this, and I want to say it to you in terms of this little picture - science is a dynamic affair. Even scientific method alters from age to age. What we now deem to be the methodology of science is not what Aristotle thought it was, nor what St. Thomas thought it was. It is not what the people of the last century thought it was. There are new features in it today. And these features have crept in during the last two or three decades. I'm saying that science is a going, dynamic, ever progressing, never ending affair. Science always moves within the entire matrix of human concern. The latter has not yet become science, and perhaps never will. Within this infinite matrix of human concerns are the disciplines of esthetics, religion, and many semi-disciplines which are objects of human interest. We do not know, at this time, whether the scientific method is capable someday of being extended to cover these other disciplines. At any rate we know that the scientific method will never put a stranglehold on them. It is a magnificent thing! It is not a cancer, that will kill what it describes and what it attacks! Therefore, the question as to whether science has its own methodology is the question as to whether the flux will ever encompass another amorphous area of human thinking. And I frankly do not know the answer to this. In fact, I believe that nobody can possibly have the answer to this problem. It is clear that the scientific method which is employed in physics, mathematics, and chemistry is creeping into economics and into psychology and many other domains. That method can be successfully described in terms very much like those used by Professor Nagel. But, man is forced to deal with other things and there are many situations where science doesn't do the trick. I can predict the fall of a penny if I measure precisely the nature of its initial release. But, I don't do it. It doesn't pay. For one thing, I like to shoot craps. I don't want to take the charm out of the element of chance. I don't apply scientific methodology and I don't want to, but, I know that I can. If my life depends on the fall of the die, I might wish to apply a scientific method. There is a vast area which one could possibly convert into a science, but, one doesn't really wish to.

I will immediately turn to the other question as to whether there is a difference between the methodologies of mathematics and exact sciences. By exact sciences, I mean those sciences which have attained, at this time, a measure

of rationality and ability to predict and to use the so-called form of deductive logic which is not common to all sciences. Exceptions are perhaps, geology, geography, botany, and zoology. Most sciences tend toward the state of exactness in which they correlate what I describe as the P facts (the protocol facts, the problem facts) that arise and require explanations with rational concepts. That is the method of exact science. Now this method has two important components on which I want to focus briefly. That is, the discovery of protocol facts and the correlation of the ideas which correspond to them. Roughly, the first is the business of the experimentalist while the second is the business of the theoretical scientist. Genius is able to do both. Now, mathematics is a truncated science in the following sense. It feeds upon the procedures in what I call the C field. It lives only by the so-called metaphysical principles of elegance, simplicity and so forth. These principles ought not to be imposed upon the constructs of some fields. It does not necessarily seek correlations and rules of correspondence with the P facts. Often mathematical theories abiding by this method live in scientific obscurity for some time. Then suddenly they develop correspondences and they become part of the applied science. Take for instance, the theory of Hilbert spaces, which became a part of modern physics. So, in a sense then, mathematics is a truncated science. It uses part of the full methodology of science but not all. If you want to say, like Father Henle, that methodology of mathematics is different from exact science, you may. But, different only in the sense in which it limits itself to one phase of the entire scientific pursuit.

Now, what's the difference between philosophy and science. Well, ladies and gentlemen, I have a conviction which I will state dogmatically. If you ever think through a scientific problem to its end, you will find yourself in the realm of philosophy. And while the scientific method as it usually is practiced may leave you at that point, you will nevertheless endeavor to apply it to the extent to which it is applicable. And, if it fails, you then must entrust yourselves to other hands.

DR. RABI - I have been listening to this discussion with great interest and one thing occurs to me. If a non-scientific person were to get a transcript of this discussion about science and the methodology of science, could they develop science? I doubt it. I don't believe science is that type of thing and I don't believe the scientific method exists, except insofar as Professor Nagel describes it. And that is only a part of it, and a small part. I don't think there is such a method, and I don't think that if you start to describe it, that you're helpful. I hear a

great deal about the scientific method in fields which are called the 'soft sciences' and they are very much worried about method. They have something to worry about! They haven't made as much progress as they would like to make. In physics, apart from a few remarks about method from the instructor at the beginning of your introductory course, that's the end of it. There is no longer any discussion about scientific method because there is not a method and the field does not have any limitations, except that given to it by those who are outside the field. As a scientist I have no objection to what Father Henle or anyone else said about it, as long as they don't get in my way. If they stay out of my way and do not claim a grasp of knowledge in the field in which I'm working, by methods which are inaccessible to me, and which are not public, then they're perfectly all right. As I said yesterday, science is a public affair. I suggested where science has moved, and anybody can follow. That's the nature of the thing and that's the nature of the scientific enterprise. What has been left out in the discussion of the scientific method of science is the whole, vital, human quality of imagination. It is not just the mechanical thing of order. The vital human quality is imagination and it is an open-end adventure. Science knows no limits and it will not be fenced in. I do not know what is meant by wholistic thinking if it's outside science. When you have a science of the universe, so to speak, and when you take all that there is accessible to you, I think that's enough. There is no objection a scientist can have to any kind of reflection or ruminations. It's perfectly all right. It can't do any harm provided you don't take it as a basis of action. If you take it as a basis of action, you have come into my field and you have to be subject to the same criteria. It's a question of thought, a preference of some kind, and that seems to be perfectly all right.

Another point I would like to make is that there is a scientific tradition. I would not accept a method, but there is a scientific tradition, and like any tradition it defies analysis. Because, it is not a precise thing, it's an attitude, a way of life. It is the kind of commitment which is natural to science or to scientists. That is application for the good of man and for humanity. You share this knowledge and you share the fruits of it. And, I think this is the kind of personal commitment which goes beyond taking care of yourself. But, what can you do, how can you apply your method, your knowledge, specifically and generally to ameliorate the condition of mankind? Father Clarke talked about the Air Force; I will also talk about the Air Force, but I will not ask it to solve any impossible problem. You more or less understand the world as a whole. Thinking like this will take a long time and take your mind off your work. But rather, let us look at the other side, how can you utilize your knowledge,

your commitment, and your power for the good, not only of your country, but for the good of mankind? You have in your hands this tremendous force which has never existed before, and we hope, after a time, will never exist again. How can you utilize this for the benefit of mankind? If you are based in science your commitment is actually a result of the scientific effort and the scientific tradition. And, it seems to be most important to have a feeling for this tradition, its breath, its humanity, and its humility in the face of nature. Be sure that you think of doing good for humanity!

FATHER CLARKE - I've always admired Professor Nagel for his great concern for the use of reflective reason. I certainly agree with him that all forms of thinking, including philosophical, come under this very general method of a reflective rational approach. One sets up hypotheses and one does some kind of testing. I agree that science is an infinitely expanding crystal which takes as its goal the explanation of the totality of the internal working of this universe. That is, as far as it could be observed and tested. That's a kind of totality. But, as soon as one asks a question about the actual existence of the universe as a whole, it is impossible to test that question by any kind of experiment or to use any predictions. There the method of testing, in a sense, is the illumination of your experience and depth. That's one purpose of philosophy - to illumine your experience and depth. A kind of testing would be whether or not this gives a total meaning to your existence. Does it give a deep happiness for example? This is one form of testing for the individual person. Now, you can't test this by an experiment or by a prediction; this is a kind of testing, but, it is quite different. Now, it is a general process of reflective thinking, hypothesis, and some kind of testing. But, the kind of testing and the kind of hypothesis is quite different. I think I could easily challenge Professor Rabi if I asked him this question. Will you accept, as a test of a hypothesis a profound deep joy and happiness given to a person's life? I think he would say that that's not science, but, it might be an extremely important kind of reflective thinking.

PROFESSOR RABI - Wait a minute! It's hard for me to answer that question. I would have to ask you one other question. Namely, can you repeat it, are you sure it isn't something you ate? I have to ask this kind of question. You must know about the kind of moods that are generated by drugs. We know that they're fearfully wonderful and this nervous system can set up situations. We do know that on some experiments, which have been made with animals, you find certain centers where they receive a kind of

joy or whatever it may be, and they will forego food to be in that state. You really have to answer a great many questions, but after you've done so satisfactorily, I would accept it.

FATHER CLARKE - You would accept that as scientific?

DR. RABI - As I said before, there is nothing which you can utter, and say you felt, which is foreign to science.

FATHER CLARKE - Then, I would say that's just the equivalent of reflective, rational thinking. Inside of that then are all kinds of peculiar methods. You can't possibly predict when you have a theory for the meaning of the universe. You can predict nothing, because its concerned with the very existence of whole.

DR. RABI - I deny that the essence of science is prediction. It has been very useful for very short range predictions. The great thing about science is its power to predict the past rather than the future. I think this is true. If you predict the future knowing that science is contingent, that we don't know everything, then we're not going to predict the future very far or very well. Some predictions of the future I can make with a fair amount of certainty - the sun will rise tomorrow. I didn't have to know much to do that. The Babylonians were able to predict eclipses without having a picture of the solar system. They made observations of the regularities, analyzed them, and used this to predict the future. It worked very well for a long time. This is a type of systematic thinking. It's not prediction that's the essence of it, it's the broadening, the widening of understanding, and the possibility of power and control. The basic thing is that it makes you feel at home in the universe. You're a part of it. You have some feeling for its structure, meaning, and extent. And, it's hopeful there will be something new tomorrow that wasn't there today. It's that kind of human effort that the scientific thing is, that's its color.

FATHER CLARKE - I accept that as the equivalent of human knowledge in general.

DR. RABI - All right, and that's what science is. At its core have been some very successful efforts. For instance, the discovery of some concepts have been very powerful. Science, to many people, seems trivial, common place. But, I ask you, to recall that science is a recent phenomena. We've understood great religions, social systems, and human nature a long time. It hasn't been until the last few hundred years that we've found ways and means of beginning to understand nature. Now it's more of a friendly thing. We know that we're part of it and we can use it. It's

not capricious. This is a great thing and I don't think one can simply describe science as a P or C plane, although that conception is useful. It's a much bigger thing. And, I don't think anything can be pulled out of it. I like Professor Nagel's point of view of philosophy. The way he watches and sees that it's honest. Scientific advance is such that you never get down to clearly defining your concepts. Here I disagree with my fellow scientist, Professor Margenau, scientific concepts are rarely clear until they are dead. By that time, people have had a chance to catch up with them. But in the growing stage they're not very clear.

MAJOR DUNN - There is a great deal of enthusiasm on the panel to make remarks but I would like to try to change the line a little bit. This is a summary of a number of questions that were generated yesterday. Much has been said about the importance of personal commitment, it was mentioned specifically, in the first two talks. This can be defined in various ways, for instance, finding a personal Savior, or finding some way of determining the importance of oneself in this life. Professor Nagel sounded like he was saying that there is a method in which one can find justification for this although it was somewhat unfair. Others have said we can find this justification through God. Still others have said that humanity provides justification. It occurs to me, in my own hesitating way, that all these involve some element of faith. Either faith in the method, faith in God, or faith in humanity. Could members of the panel, who obviously have their own deep personal faith in some of these various thinkings, expand or enlighten these thoughts?

PROFESSOR LEHMANN - Professor Rabi made a distinction, in his remarks, between scientific tradition, which he said defies analysis, and science itself. In the scientific tradition, he brought out the point that there is a commitment to humanity. Now, I suggest that this is something which is not a result of science, but, which is an article of faith. It's of a religious nature, not a rational thing, and yet it's very much a part of the tradition of science. Do you, Dr. Rabi, include this in science or do you really make a distinction?

DR. RABI - I think that it is there. Why wouldn't you include it? I include it! I said it's part of the scientific tradition. That's the way scientists behave and that is the way scientists intend to behave. They have a feeling for the utility of their efforts in the sense of humanity. They have a commitment, for example, to make public the results of their findings. It's necessarily a public affair. It's not a private affair. It's not a private illumination which you find. It's an illumination which you want to make public. Now, some of these inner

illuminations, which come with a private, inner illumination, you can't make public because you don't know how to talk about them. This is your own affair. This I would say would be outside of science. If a man told me he had this, I would say good, this is something for psychology, physiology and neurology.

PROFESSOR LEHMANN - But do you feel the commitment itself comes from science or scientists?

PROFESSOR RABI - Science, if you want to call it a dead thing, it's in the book.

PROFESSOR LEHMANN - Science is what scientists do.

PROFESSOR RABI - I would prefer if you would have said - have done. What scientists are doing, that's a different thing. That's a live thing. That's a movement and it's an entirely different affair from picking up a book of tables, a book of theories, or a book of mathematics. When I talk about the scientific point of view, I'm not talking about the descriptions of methods which have helped people discover and verify theories in the past. I'm talking about the here and now. The way scientists think and behave.

PROFESSOR LEHMANN - Your definition of science differs from some of the other panel members.

PROFESSOR RABI - As I said yesterday, I'm a laboratory scientist. I'm here like a miner at a coal seam. It's a different point of view from the fellow in the rear who's only helping.

PROFESSOR NAGEL - I would like to say something along the line of Professor Rabi's remarks, but, with a different turn. To ask whether something comes from science seems to me to be a bit misleading, because, motivations don't come from a body of knowledge. Motivations are individual motivations and certainly the motivations of individual scientists vary. Some of them have a motivation that Dr. Rabi described. They're engaged in this enterprise because they wish to benefit humanity. Others don't have this. There have been many scoundrels in the history of science, people who were interested only in fame and personal wealth. They had no thought of humanity whatsoever. And, as a matter of fact, often the people who have used humanity as a motive have done the least effective work in science. If I ask whether a commitment to humanity comes from science, I should say no, it doesn't come from science. It comes from whatever the individual drives are that lead people into one kind of commitment rather than another.

If you look at the history of science for, let's say, the last two thousand years, it has contributed to the welfare of humanity. Science has been an effective instrument for the weakening of superstition, for the weakening of certain barbaric practices. It has prolonged human life. It has made life, for many of us, more bearable. If you look at it from this point of view, then certainly science is humane. But as far as individual motives are concerned, it's not the proper way to ask the question, that is, whether it comes from science. Where do individual motivations come from? They come from upbringing, your exposure to your contemporaries, what you read, the inspired religious literature. There is no simple explanation for this. We don't really know all the factors that lead people to engage in one kind of life or another. You certainly would never find a statement like - the object of science is to benefit humanity. This, in a way, doesn't make very clear sense to me. It is important to recognize the fact that the motivations may have different sources. And, why should not one admit that one has been inspired by various religious leaders. But, it's not the only one. And, it's not the indispensable one.

FATHER HENLE - These remarks bring us back to the start of the discussion regarding personal commitment. Professor Nagel has said, in his own way, something I was trying to say yesterday when I spoke about notional and real ascent. Motivation does not come from an abstract body of knowledge. The latter could be science or theology. There have been as many scoundrels in theology as in science. Many people have been able to define virtues without practicing them. So, it is not from an abstract body of knowledge that motivation, ethical, or moral principles are derived. It must be a concrete realization. On the other hand, it's not something completely divorced from knowledge, unless you are going to equate knowledge with the type of knowledge you get in physics, and chemistry. If you do that there's no room left for some other kind of knowledge. It's a fact of human experience that there is another kind of knowledge. If motivation comes from religious inspiration, this is not just a feeling, this is from an understanding of some view of the world, some understanding of human nature and some understanding of the purposes of God. So, there are kinds of human motivation in our character, there are pushes and drives which are hidden, and there are rationalizations that we can't always untangle. I'm talking about the conscious motivation that we have managed, by reflection and so on, to untangle. I agree with Professor Nagel that this personal commitment can be of different kinds. But, if it is a genuine human personal commitment, it will be a moral kind, or a religious kind; because, it will result from an overarching view, or some fundamental wholistic view of human

nature. Yesterday I left this as a problem. A number of you have asked me privately, while others have indicated this from your written questions, how can you do this at different levels. All I can do now is to make a statement about a position. I think in human experience every man has (Professor Margenau talks about his cognitive and volitional life) this to some extent. Some people have it to such a small extent that they hardly live a human life, but normally, ordinary human beings have this. In our encounter with experience, and in the traditions which we are raised, we develop a total view of things which includes many different elements. Some of these are superstitions which we've learned from nurses, while some of these are traditions, which we have been told about. Inside of this complex mixture of superstition, false ideas, wrong inferences, and half truths, every human being has in some fashion (though he doesn't use this sophisticated language) a recognition of himself as a morally responsible agent. I think that this is implicit in the natural knowledge which people acquire prior to any sophisticated investigation of knowledge. This is level of knowledge prior to any reflective sophisticated thought. All the types of knowledge that show up as sophisticated cultural developments aren't dead, they're like an embryo. Professor Nagel, has indicated in his introduction, the relationship between this kind of embryonic knowledge and the more recent scientific method.

The same thing is true with regard to moral knowledge. The same thing is true with regard to certain kinds of basic religious knowledge. It is common human phenomena that people do in some fashion, whether they are savages, pygmies, or cultivated and sophisticated Egyptians. They have recognized themselves as moral individuals, with some vague recognition of responsibility and obligation. They have some kind of wholistic view of the universe. I'm not talking here about a cosmogony. I'm talking about a personalistic and value-filled view of the whole. I think that almost every man comes to this. A problem arises when you come to sophisticated levels of knowledge, that is you have to rethink all this in the light of a fully sophisticated kind of knowledge. Here is where the problem arises that we've been talking about. If you are going to say that the only kind of knowledge you are going to allow to grow out of this embryonic human experience is a certain type of knowledge, then you're going to have to say the others are crude common sense, superstitions, socially conditioned, and culturally relative. And, you simply cannot permit them to grow. So, this is my position with regard to this. We all have some of this, the difficulty of the sophisticated civilization is that you must do this at a sophisticated level. And, you must do it with the best objectivity one can achieve.

No two people will do this exactly alike, they are all going to have certain subjective elements. And, as long as I've got the floor, I would like to say, Professor Rabi, that you have the best of all possible worlds. Because, on the one hand you can throw me out on the scientific method, and on the other hand since everything is in flux, it uses the scientific method. You won't be precise about it! You won't let us be precise about it! You bring anything into it that comes along! May I say for a scientist, you are an excellent rhetorician. Also, I think that you're impinging on my field, because, you have preached to the Air Force. This is one of the difficulties I talked about yesterday. It seems to me, that if you say, here's rational thought, we can say, alright, what can rational thought do? You say that it can do such and such. I say there are some other things. And, they can be described by rational thought. You say, that's superstition, it's something you ate, or it's something you learned from your mother or at another low joint. This is the same problem that I've always had in talking to a disciple of Dewey. Professor Nagel is very explicit about what he means by the scientific method. He has done an analysis of something which is dead. He's done an analysis of what is a going concern. I would also say that there is no science in books. Science is in the minds of men and if all men who understood it died, our libraries would have no science in them. It's in the minds of men. It's the concern of human reason and it can be analyzed. And, it can't be analysed by physics! Even though physics is the total universal system of knowledge. There is a knowledge which permits an analysis of the method used in physics which is not itself a proposition of physics. So that physics itself, or the whole range of what you want to call this precise science, cannot on the face of it, be the only rational approach to the totality of human problems. It can't approach what you call the scientific tradition. This, as you said, defies analysis. But, you know something about it. That tradition is not one of the propositions of physics. It is not entailed by any of the propositions of physics. I would say, in the Western World, that the tradition comes out of a combination of the Hebrew, Christian and Greek traditions. This scientific tradition came and can be demonstrated in the beginning of the last part of the 12th Century. At this point there was a shift from the old biblical and Augustinian view of things to a rationalistic, Greek interpretation. This movement took up the Greek tradition and combined it with the early Christian tradition. This is not a proposition of modern physics, and if it is true, it means something which cannot be analyzed by physics.

DR. RABI - I subscribe to what you say if it's a matter of definition. But, I don't believe that you can define me out of my legitimate concern. If one was present at Alamagordo and has seen that thing happen, you have a concern. You can say to me you have a concern, but it's not physics. I'll answer that this grew out of the thing. It hit me right there and, if I'm not going to talk about it, who will? Do you want those, who do not clearly understand the implications, who do not clearly understand the developments, to talk? You say that I stepped out of my role, and all I can say is that you may define the art of my obligations, but I'm not like you. I am saying that this is my role, and it's part of physics, it's a living thing. And this is physics for instruction in classrooms. And, it's a physics which can be labeled as a method of organizing human activity, human experience. People can put labels wherever they please. But what I'm trying to define is a living, human activity. This is the scientific adventure. I was not defining it as a method. I was defining it as something which grows organically out of developments as they occur. And, it's certainly true that some individuals wouldn't feel this at all. We're not all the same. But, having this feeling is a part of the thing.

FATHER HENLE - It's part of you as a physicist. It's not a part of the physical enterprise. Your realization as a human being as to what terrible effects this thing has must have been derived out of something beside your science. And, it probably came from certain human things, things that came from your tradition, and that came out of the religion of your ancestors. Some of these combined to create this concern. This concern does not follow from the fact that you're a scientist. I would say that the fact you're a scientist increases your obligation as a human being to have this concern. But, this is much more than a scientific concern.

DR. RABI - It's a perfectly good way of talking about it, but I can't agree.

PROFESSOR NAGEL - Let me make just one brief comment. Father Henle has reminded us that some of the questions that we're discussing go back to antiquity and then were transmitted through the Judaic-Christian tradition; wouldn't you agree, Father Henle, that in the writings of some of the outstanding ancient thinkers, like Aristotle, that this distinction between philosophy and physics is not clear? For example, Aristotle reflected on the procedure that he engaged in. And, it is not only Aristotle, but you can find this in Maxwell. That is, in his basic paper on electromagnetism. A large part of it is very fascinating to a contemporary philosopher; because, it does involve a great deal

of methodological reflection. Or, you can look at Einstein's special theory of relativity. Or, when you are discussing the notion of simultaneity - is this physics or philosophy? The division that we make today between what is philosophical and what is physics, is a part of a growing specialization with which we are burdened. This specialization has its advantages, but, I think this age tends to overlook the continuity between doing a job and reflecting on it. This reflection is sometimes essential for doing the job better. Does this include a question that would be moral. This, I think varies. Offhand, I can't cite an example where moral reflections rise out of these considerations. Although, in Newton there are considerations of this kind. To what extent these are really required by his physics is difficult to say. But, they weren't just added. We make a sharp distinction when we say, this is Newton's theology and this is Newton's physics. I am inclined to urge as the division is one of convenience rather than one of substance.

FATHER HENLE - Certainly, Professor Nagel, the differentiation of disciplines within our western culture has been a matter of historical development. Many of the disciplines, and even methods, which we use today did not exist for many centuries. One way of writing the intellectual history of the west is to write about the differentiation of the disciplines. For example, I would point to the effort the great thinkers made in trying to understand the mathematical discoveries of the Greeks. I would say that some of the difficulties and problems that we have in understanding Plato are due to the fact that we are not aware of this specialized mode of thinking. In Aristotle you recognize the geometrical mode of thinking and this is not the kind of thinking that we want to do. In Aristotle, what I refer to as modern physics, is there in a very embryonic way. The pure type of science wasn't there to be reflected upon. There was confusion around the edges between philosophical and scientific questions and answers. The prize example of all was the theory that everything is water. You can bring this point home to a class very well by asking whether this is a metaphysical or a physical question. The answer is that he, Aristotle, wasn't asking any of these kinds of questions. The matter was still undifferentiated. On that point I agree with you. But, I must disagree with you when you say that the distinctions which we now make between basic ways of thinking is one of convenience. I think we have come to organized culture by recognizing certain real, intrinsic differences in attitudes, and mental approaches. I'm using these words instead of the word we've been working to death - methodology.

FATHER CLARKE - I would like to comment on the question of faith, and, whether or not faith is involved behind all these enterprises. Behind all enterprises and modes of intellectual explanation is required a basic faith of some sort. I didn't say experience; because, you can have experience without faith. When you start to explain there is a basic commitment of faith this can be put in this way. In science, for example, the world is assumed to be basically rational, it makes sense, it is not purely arbitrary, and some kind of order can be understood by the intelligence. This is basic before you begin any explanation; because, if you deny this before you begin, there would be no use in trying to carry on at all. Now, this basic kind of faith (Vannevar Bush pointed this out in his article on Science) lies behind science and philosophy. When one is concerned with science, this can remain very vague. As I said, it can be expressed as basic faith or commitment in the fact that the universe and its internal workings are rational and can be discovered by human intelligence. A faith in philosophy would go further and extend this to the very existence and ultimate meaning of the universe and man in particular. A faith in religion would go even further and this would flower into a very personal relationship with the author of all this. But, behind all of these intellectual enterprises is faith. I think this is extremely important to recognize. There is no rigorous presupposition in this kind of explanation. There are no rigorous proofs which are completely adequate strictly by themselves.

MAJOR DUNN - Does that imply or prove the existence of God?

FATHER CLARKE - Yes, I would say it implies it. I think it's impossible to prove the existence of God in a completely rigorous way at least in the modern sense of a proof. Once I have made the basic commitment that the meaning of myself and the universe are not absurd, then I can go on and search for what is, in particular, the intelligible. But, this very profound faith that underlines all of these enterprises doesn't come out of science, it comes out of a man as a whole. It's a very mysterious kind of thing. You can't be considered illogical, in a strict sense of contradiction, if you make an option for the absurd. I think the way the argument for God would go, that either God exists, or I am absurd. Now, you can choose the absurd if you want to and there's no logical contradiction there. But, there's nothing reasonable either. It's an option. But, once you take a basic option for the rationality and intelligibility of being, then you can carry on the various enterprises. What underlies this mode of explanation is this basic faith.

PROFESSOR NAGEL - I hate to be terribly difficult and disagree with my colleagues, but, I'm distressed by this view that there is a state which is the presupposition of all explanation. The word faith itself has a variety of different senses. If I walk across this room, I suppose it could be said that I have faith that the floor will not collapse under me. This is faith in one sense, yet, in another sense it isn't; because, it's synonymous with saying that the structure has been built in such a way that it will sustain weights of a certain kind. To call that faith seems to be using the word in a very peculiar fashion. On the other hand, it is not necessary to think that you must be committed to a faith in the rationality of the universe before you begin the enterprise of science. I certainly think that people who are engaged in trying to solve some problems hope that they will find an answer to it, but surely, it's not a condition of their undertaking the problem that they will find an answer. It seems to me that these two questions are separate. I would agree that unless people did have a great deal of confidence that their efforts would be successful perhaps they wouldn't undertake them. But, it's certainly not a presupposition of the enterprise of science that the universe must be rational, in the sense that you will be able to find a solution to whatever it is that's bothering you. As a matter of fact we know that a great many outstanding figures maintain that there must be a particular kind of organization of the universe. They have faith, if you like, in it. Really, it was a hope that it would be that way, and, it turned out they were mistaken. Einstein, to the end of his life, was hoping that a different kind of a physics would eventually grow out of the present one. He hoped that the alledged indeterminacy of the present physics would be replaced by one that's more like the classical field theory. Now, maybe someday his hope will be realized. But, it's certainly not a presupposition of his undertaking. So, I'm really puzzled by this appeal to faith. And particularly, a faith that seems to indicate, that you must be committed to some kind of a notion that there's a cosmic order. And, this is not a faith in a cosmic order in general, because, no matter what the universe would be like, it would have some order because the notion of an absolutely chaotic universe is fundamentally incoherent and contradictory. What you hope is that the universe will have a particular kind of order which you will be able to grasp. And no amount of confidence that the universe is of this kind is any ground for maintaining that it is of that kind. This is something that only the future will tell.

FATHER CLARKE - I would like to qualify what I said. I certainly wouldn't say that I must have a faith that I can achieve a particular answer in my lifetime, or perhaps in the whole history of

the human race, or that the end will be of a particular kind. But, we must have a faith that this world is susceptible to some kind of rational explanation, whether or not we can reach it is not too important. I think that would be, in that very general sense, a kind of condition.

MAJOR DUNN - I would like to break this off here, since we are approaching our time limit. I believe General White would like to make a comment.

GENERAL WHITE - I would like to make a few concluding remarks at this time; because, I regret that I will not be able to be with you this afternoon for the conclusion of your meeting. We certainly have heard many different opinions expressed during this past day and a half and this is as it should be. I feel that such a multiplicity of views really has marked the success of this year's symposium. As a closing remark, I have another view which is not representative of Father Clarke's wholistic concept but it is at least vaguely related to the general subjects we've heard discussed. This view is in the form of a poem and while its scientific and philosophical substance may be questioned, its reflections on ethics should go unchallenged. I personally have faith that the last line of this poem is a valid conclusion. So I'll read the poem now if I may. Remember the last line if you will.

Three monkeys sat in a coconut tree,
Discussing things as they should be.
Said one to the others, "Now listen you two,
There's a certain rumor that can't be true.
That man descended from our race,
The idea is a disgrace.
No monkey ever deserted his wife,
Starved her babies and ruined her life.
And you've never known a mother monk,
To leave her babies for other to bunk.
Or pass them from one to another,
So they scarcely know, who is their mother.
And another thing you'll never see,
A monk build a fence around a coconut tree.
Why, if I'd put a fence around that tree,
Starvation would force you to steal from me.
Here's another thing a monk won't do,
Go out at night and go on a stew.
Or use a gun, or bomb, or knife,
To take some other monkey's life.
Yes, man descended the onery cuss,
But brother, he didn't descend from us."

OPEN FORUM

MAJOR DUNN - This afternoon, the panel will entertain questions from the floor. We again ask you to speak into the roving microphones so that we can record your question on the tape and then transcribe it. Let's have the first question.

FLOOR - I would like to address a general question to the panel for discussion. What do you feel is the moral or christian position with respect to the nuclear age and where does the individual responsibility lie in this regard?

FATHER HENLE - There are two questions with regard to the nuclear age. This age is simply a period in the history of the human race in which people have the benefits of nuclear power. The christian view of that possibility is the same as the christian view of any instrument or any technological product that man has created for use. Namely, that it ought to be used properly for the advancement of mankind in whatever way is appropriate to it and that individual judgments about how it is used in individual cases will depend upon the circumstances. I don't think any other general view can be given. That is if this is the intent of the question. The christian view is optimistic, but it's a view that's prepared for the worst in the nuclear age. I don't think this is a new problem to christian ethics. It merely magnifies problems that exist already, but on a larger scale. The christian ethic with regard to a revolver, or the christian ethic with regard to medicine, is basically the same when applied to any other kind of a technological advance.

DR. LEHMANN - Particularly when you apply it to mass destruction or the killing of people. One individual can be only 100% dead! My understanding of the christian position is that each individual is precious in the sight of God. And, whether you are doing it to one or whether you are doing it to one-hundred million, a fundamental distinction is not obvious.

FLOOR - Maybe I could clarify. Really, I think the distinction I was trying to make was in the second portion of the second part of the question. If one takes a revolver and shoots someone, then he's clearly responsible for his action. With regard to the nuclear effort, I think that there is a difference here in the particular role that an individual plays. I was wondering how he accounts and accepts responsibility for the group action of his times.

FATHER HENLE - The same principles apply that have always applied to group action. It's a prudential judgment that takes into account the position which the individual has within the particular group, the clarity of the case in question, and finally the condition of the individual conscience with regard to a particular decision which becomes a group decision. It's conceivable that there is a group within which decisions do not rest on individuals and therefore they would have no responsibility in making the decision. But, the decisions are made and they're part of the group that's supposed to carry them out. Again, it would depend upon what kind of situation exists between the decision and their consciences as to whether they can participate in carrying it out or not. For example, in the case of war, you have a group decision to declare war. There are some people whose consciences with regard to war are such that they cannot participate in any warfare, they become conscientious objectors, and they should, if that's their conscience. Other people may be in a position where they have no conscious block in participating in a war, and so they're in no position to make a rigorous judgment as to whether this particular war is just or not. In that case the cohesiveness of the group would demand that they participate in the war up to their full potentiality. The principles of group action have not changed because the instrument that's in the hands of group decision is larger or more deadly. The principles are still the same. Every man has to make up his own mind with regard to items like this and at what point he's going to take the responsibility.

If your question is about a person being in a position where he can exercise responsibility and flees from it, then this is a different proposition. If the position is such that he ought to be assuming responsibility, then of course, by a christian principle he is in moral error and sin if he flees a responsibility and does not participate in making the decision. Principles are so varied that it's hard to make a universal statement about it. What happens in a fire fighting company, for example, when it's rushing to a fire? This can't be done with the democratic process. They would all stand around and argue which way they're going to go into the building. This has to be pretty authoritarian. The same thing applies to a surgeon in the operating room, he can't hold discussions with the nurses as to what's the proper thing to do next and let everybody participate in the decision. You have all kinds of group situations where decisions are made and where people are obligated to participate in them. You can not give anything except general principles of this sort. Each case has to be judged on its own merits, by each individual ultimately.

PROFESSOR MARGENAU - I hesitate to speak since as a scientist it does not behoove me to make any comment; because, I firmly believe that science does not present the material for the generation of

ethical norms. I have not had occasion to elaborate on this question; therefore, I am reticent to speak. But, I should like to say that as a scientist this does not concern me. As a man this concerns me immensely. Now, this is a question of ethics and I think there ought to be a clean, simple answer to this question. I regret that the answer has to be as long and wheezily as the one we've just heard. If an answer like this is necessary, it speaks of our immature way of ethical thinking. It speaks of the internal conflicts of christian ethics at the present time. There is no unique voice which speaks for christian ethics, and I regret this. I wish I could remedy it.

FATHER HENLE - I think this is a failure to distinguish between ethical principle and moral decision in individual cases. There's no person outside of the rationalistic school who would attempt to give general principles which could be applied mathematically to individual cases. Mathematical in the sense that a precise, simple answer can be given. In christian moral theology, the individual faces situations as they arise. These situations are not such that the application of some simple principle can yield a decision. This is the agony of the individual conscience. No church, no group of christians, can lay down principles such that they can be applied, in a simple way, to all situations of life. Ultimately there is an area of prudential judgment on the part of the individual which must be respected and which measures the difference between general principles and individual cases. The moral decision, the sin or the act of virtue of the individual is in many ways unique. It's not like the quantitative reproduction of experiments in physics from which you deduce abstract laws which will fit exactly. You cannot do that! And, for that reason, any answer to this question has to be general, has to be complicated, and cannot be simple; because, we've got to respect the uniqueness of the moral judgment in the situation of the individual case. And I cannot prejudge the cases, I have to know the particular case and this is the agony of the christian confessor, or the christian advisor. I don't see that this is immaturity at all. The immaturity is in the thought that there are clear, simple answers to moral problems which can be applied across the board. That's real rationalistic immaturity!

PROFESSOR MARGENAU - I could make a similar speech about the individuality of scientific observations, of scientific knowledge. All cases of scientific measurement are unique. As I survey systems of ethics, across history and across the globe, there are some which rely on very general principles, like: love thy neighbor, the ten commandments, and thou shalt not kill. And, they do not say under what conditions you may kill. What I'm saying is that in our western cultures we have, perhaps, adhered too stringently to the rigor of commands and have not taken the

trouble to speak out their meaning with respect to individual cases. We've been guilty of neglecting something which is usually designated by an odious word namely, causality. Men like Father Henle are perhaps prominent in the view one must pursue causality to the extreme. One must teach people how to apply the laws of ethics. This has not been done sufficiently in our society. We have neglected to do this and part of the problem that arises, part of the crisis in ethics that confronts us, is due to a misunderstanding of the fundamental norms, to a misunderstanding of what it means, thou shalt not steal, thou shalt not kill, and love thy neighbor. And, I'm arguing that people like you Father Henle should make a strong endeavor to dispell these misunderstandings. Now, there will still be many cases which are individual and unique, surely, and with respect to these some such considerations as you've voiced will apply. But I think the area of uncertainty in ethics could be vastly reduced in size by following the lines which I suggest.

FATHER HENLE - May I recall to you that causality was created by the Jesuit Order. And the libraries are cluttered with it. The effort to define, and refine, and to apply norms to individual cases has gone on endlessly. Sometimes to the point where many say that it no longer makes any sense. I agree with you. We've got to keep up this effort. I'm not proposing, and I can't imagine anybody thinking that this was what I was proposing, that we go around making bland platitudes about love your neighbor.

Catholic moral theology and Catholic preachers have reduced these things to an almost infinite number of specifics. Catholic thinkers have made every effort to determine the conditions under which a war is or is not just; but, when you come back to the individual conscience I will reiterate the speech to which you referred. And since you didn't pursue yours, I will simply deny the parallel between the individuality of the scientific experiment and the uniqueness of the human decision which is made at this point in time, by this individual, in this set of circumstances, facing his conscience and his God. There is no way to guide him with a rigor and a simplicity that you have talked about. Certain general principles have been imprinted in the minds of people to such an extent that when they're faced with a situation where the general principles have an exception, they can't make an exception, and therefore they do some horrible thing in the name of christian or religious morality. I think the danger, at least in the Catholic church, is not that we're not explicit enough but that we're too explicit.

FATHER CLEARKE - Could I add a brief word? There certainly is a general responsibility on the part of all of us with regard to

the norms for making the decisions in this thing. For example, that a nuclear decision would not be made purely on military grounds without being set in a wider context of political and human control. This is a general responsibility that nobody can abdicate.

FLOOR - We talked about the boundaries of science this morning and I had some questions in my mind about the constitution of religion. Specifically, Dr. Nagel talked about the man who knows a little philosophy turning away from religion and the man who has had a greater depth in philosophy coming back to religion, but, a religion that may be quite different. I believe that Professor Nagel considers himself to be a religious man, although he evidently does not believe in God. I would like to ask Father Henle and Father Clarke whether you would consider Dr. Nagel a religious man?

Another question that was raised in my mind, resulted from Dr. Margenau's diagram of the P field. He suggested that religion did not belong in this plane at all, and that it was a third dimension which could be connected with this plane, the P field. This would make religion mystical. It would exclude theology and theology is a rational process, something I believe would belong in the C field. So I would like you to comment on those two things if you would.

MAJOR DUNN - Professor Margenau would you like to address the second portion?

PROFESSOR MARGENAU - Yes. Sir, I don't believe you have asked a question. You have stated a position that happens to coincide with my own. I gave a survey of the variety of approaches which lead from science to religion. And, this one which dwells in the immediacy of the P plane and possibly looks upon the whole pursuit of science as an enterprize in a dimension different from its own does lead to the sort of description which you have given. It is largely mystical, it is not pervaded by reason and does not claim to be pervaded by reason. You may have noticed that I am not altogether sympathetic with this approach. I would prefer a religion which leaves room for rational theology and that would be the third one that I gave. I characterized this religion as an extension of the present scientific method, one which acknowledges its own problem, protocol, or primary fact plane, and extends this plane into the rational field by certain deliberations which we now call theological. Yes, you have these two possibilities, and I think the former one, the one you mentioned in your question, or comment, is more germane to oriental thought than to ours. I'm convinced that this experience, the immediacy

of direct contact with divinity, is involved in many religious acts of the Hindu's, Buddhist, and other oriental types of religion. It is very definitely irrational, although not wholly so. Things are never quite black and white, you can always talk about these things and if you talk about them you are injecting some sort of rationality. It may not be the kind of logic to which the scientists appeal, but it's a kind of methodology. I use the word in spite of Dr. Rabi's objection.

FLOOR - Could I ask Father Henle or Father Clarke if they would consider religion to be a mystical sensation?

FATHER HENLE - Your question is susceptible to two interpretations. One which has to do with the extent to which I would permit the word religion to be used to designate such a kind of thing, and secondly whether I would be sympathetic with that kind of religion. Do I interpret this correctly, are both of those included in your question? With regard to the first part of the question, religion has actually been used in our language to cover this type of thing. And, from the viewpoint of a dictionary I could not really quarrel with the extinctions of religion to this sort of experience. If we are going to talk in some evaluative sense we might refuse to call astrology a science, not because it didn't present itself as a science, but because when we evaluate it, we don't think it deserving. If I understand the description that Dr. Margenau gave of this, I would not consider this to be religion. Of course, I also use the word mystical in many other senses. But if I understand that description correctly, I would not really want to call that religion.

FLOOR - I would like to address this to both Dr. Rabi and Dr. Nagel. This morning Dr. Lehmann pointed to a distinction which I don't feel is true except in a very relative sense. Science is only relatively precise. I feel that you cannot know all about anything because anything is related to everything else. This would imply all knowledge, to know all about a thing. Therefore, you cannot be absolutely precise. Our knowledge of anything must be like a series of approximations which depends upon the number of terms one knows, realizing that one can never know all the terms. Someone once said that science and religion are like two wings of one bird, and that both wings are necessary for flight. Now, I suggest that religion and science are ultimately the same and that they are like two asymptotic lines approaching each other. Perhaps they are distinct now because of the lack of knowledge. Dr. Rabi said that in viewing the atomic explosion he felt a sense of responsibility. This feeling has nothing to do with science or with physics. Even though I am not a physicist, I can be as horrified and as aware

of the potentials as any physicist who witnessed the event. I felt that several panel members were suggesting a unified system of ethics and morality that could be arrived at through science or philosophy. Plato said that the ideal state must be based on religion; because, only religion has the power to get larger numbers of people to do that which they would not do ordinarily. Science cannot do this. If science cannot do this, then I suggest we have a responsibility to find something that will and support that thing. I would like to suggest that the responsibility for what comes is not just in the hands of those who take direct action, but, it is in the hands of those intellectuals who refuse to take any action, to make any decision, or to make a personal commitment for something which will provide a system of unified morals and ethics. I would like to ask the panel whether they feel that philosophy or science can provide us with this thing on a practical plane?

DR. RABI - I think the gentleman has asked and answered his question. I don't know what he wants. Could you say something simple, just a sentence or two and then maybe I could catch on?

FLOOR - Dr. Rabi, I had the feeling from your talk that you were not willing to support a particular religious conviction because you felt that science could embody this ethic.

DR. RABI - I never said that. If you had that feeling, you are entitled to it.

FLOOR - We want a practical system. We have to have something more than just vague generalities. We need some answers today. The time is short as Einstein said, terribly short. We must act now if we're to act at all.

DR. RABI - Well, I agree with you that the time is short and that we should act. I don't think that big principles help you very much. A theory doesn't help much until you have done some problems and examples. You understand by doing. We have any number of right principles of action floating around. All we have to do is apply them. I think you know perfectly well what we ought to do. I don't know how to answer this question in this form, perhaps my colleague does.

DR. NAGEL - May I make two comments. You want a unified system of ethics that can be taught to a bushman in Australia, a spear carrying native in Africa, as well as somebody who lives in Greenwich Village in New York. Do you think that is a reasonable thing? Do you think it would be reasonable to develop a unified system of physics which a bushman in Australia would be able to

understand? That is not entirely reasonable. The second comment is on the statement that there are available, either on the part of science, philosophy, or religion, answers to all the problems that face us. If there are, it's been kept a secret from me. As Dr. Rabi just said there are a great number of general principles, but when one comes to very specific questions they are obviously inadequate. They really don't tell us what to do. Let me take one example. It may well be that everybody would accept the general proposition that taking private property is undesirable. The question is, what is private property? These conceptions change. In our country we have gone through a period where whole ideas have been transformed. There used to be a time when a man who ran an industry could do with it whatever he liked. When attempts were made to curtail his power this was regarded as an infringement on private property. Well, today we have changed conceptions of private property. The same thing is true about a great number of other things. Nobody can give you a general answer that you can apply in all particular cases, no system of ethics can possibly do that. There is always the business of trying to interpret the material in light of general principles and modifying the principles in the process. So, if I may try to answer your specific question as I understood it, could a group of philosophers relatively competent and gifted with a reasonable amount of intelligence sit down and work out a system of ethics? Yes, they could do that. That's easy. After you've done that then all our serious problems begin. But then you see that I'm not in an inferior position to anyone else. I think all of us are in the same predicament. Taking your other question - are there available anywhere a definite set of answers to all the problems that face us both domestically, internationally, personally, and publically? The answer is no. There are proposals, some of them work, some do not. People are not willing to abandon some of their well entrenched views and this is irrespective of religion, creed, race. I mean we hold on to the human predicament. To readjust our ideas in order to meet the tremendous problems that face us is difficult. Even if we knew what the answers were it couldn't be done overnight. It would certainly require more than twenty years. For example, take the problem of readjustment in the South. Now everybody might agree that it's wonderful to have all people treated alike irrespective of color, but, how to implement this without completely upsetting the apple cart and destroying the social fabric, is not an easy problem.

FLOOR - Is science or religion further towards attainment of its goal? Yesterday, Dr. Margenau placed the protocol plan on the board and drew diagrams to the left for science. The question could be resolved into the following, does science have more diagrams or latices than religion? I would like to direct this question to Dr. Margenau.

DR. MARGENAU - The diagram was meant to represent neutral methodology of science, and I use the word methodology advisedly because Dr. Rabi doesn't believe in such things. We all agree that there is no one method of science. But, there is a large mode of inquiry and there is a style of progress which one sees in all the sciences. It is this which I meant to schematize by that diagram in which the P plane was something like the problem plane in science. It represents the sort of things you cannot explain within themselves. I sketched what I called religion. This was an extension of science in the sense of a very general, neutral methodology. In the face of these facts, you ask the question which has progressed further toward its goal, science or religion. I would be moved by impudence to say science has moved further. But, having said this, I would want to check myself and qualify my answer, or perhaps even negate it. It is certainly true that science has shown more detailed material progress, it has been more precise in its predictions and more illuminating in its understanding. Also, it has attained a greater measure of general acceptance than religion or ethics. Here I would deny an allegation of Dr. Nagel's, he said that it is impossible to teach science to the bushman. It is not impossible to develop a system of science which is accepted both by the men in Greenwich Village and the bushman in the interior of Africa. Such a science does in fact exist.

DR. NAGEL - You misunderstood me. I believe the question was could you formulate a system which would be understandable by the bushman.

DR. MARGENAU - Well, understandable is another question.

DR. NAGEL - Well, that was the question.

DR. MARGENAU - I don't believe that was the question. I think the question concerned the availability of information which is regulated and controlled.

DR. NAGEL - I know that there are branches of science which are available. So, I think you ought to show a little charity too.

DR. MARGENAU - The point I'm making is that science is clearly universally accepted, and ethics is not. This is the sad story of ethics in spite of the claim that ethics can never be as solidly structured as science. I want to add these remarks. The progress of science toward its goal is an asymptotic affair. Science will never reach its goal. And, I'm sure that as long as men exist they will practice science. They will be facing questions that are unexplained. Religion also approaches its

goal, if it has a goal, merely asymptotically. The situation is even worse than it is in mathematics. We don't even know whether science has an essence or whether it has a limit which we can approach. In this sense the answer which I first gave, that science is further along than religion, is in error. Nevertheless, if volume of achievement, or if the precision of results and the technical competence were used as a measure of progress, then I would say that science is much further ahead. It is my own belief that the lack of reflection upon the structure of science and religion has retarded the acceptance of certain religious beliefs. I confess that this is quite dogmatic.

FLOOR - The question that I have is interesting and I hardly dare ask it. But, we, the western world, apparently feel ourselves to be at war ideologically with the communist world. And we say that atheism is a consequence of communism. We also know that the more fundamental religions have generally been anti-communist. Suppose the world in general loses its faith in a personal type of God regardless of what it believes at the present time. Do you think that communism is the ultimate consequence of the loss in the belief of a personal type of supreme being?

DR. NAGEL - I will put my neck out on that. I don't see that there is any essential connection between communism and atheism. I think that a person can be an atheist and be a violent opponent of communism. There have been Christian forms of communism in the past. So that I think the question is like - have you stopped beating your wife? It doesn't seem that the assumptions on which the question was based are sound.

FLOOR - I'd like to address this question to Father Henle and Dr. Lehmann. Hasn't religion been established by the same methodology as science? The main objective of most religions is to obtain life everlasting and this can be found through reasoning and deducing. People do have faith. And these faiths are merely operations established through reasoning whereby life everlasting can be obtained. Isn't there a parallelism here between science and religion?

DR. LEHMANN - I don't see it. One of the points I tried to make is that in science there are precise definitions and precise observations. I don't mean to imply that there are no elements of reason in religion, but, I do want to say that there is a distinct element in religion which is not reason. That element is faith. This faith is something that gets very imprecise. When someone speaks about life everlasting I am not sure what they are talking about. I know that Jesus Christ said that there is life everlasting. Maybe someday I'll find out what

that means and maybe I won't. It's this imprecision that takes it outside of science. I use the word science in the sense that it involves definitions and not in the sense that Dr. Rabi used it.

FATHER HENLE - Before I answer the question I want to make a number of distinctions. We have used a lot of words these two days without trying to make the roughest definition of them. One of these has been religion. We have permitted almost everything to be brought in under this term. We've not tried to make distinctions between the various types of religions which have existed historically, which people have called religion, and which are generally admitted to be religions. I don't think your question could be answered without making some distinction within the things you wish to call religion. Let's take Christianity, and let it be a specimen for purposes of discussion. We have talked about Christianity as having developed moral principles, and religious doctrine by methods analogous to science. I think I would have to say that this is false. This is not true. If you consider the methods of science to be the operation of the human intelligence, then human intelligence is operative in the development of any kind of doctrine. Doctrine is something that you know and understand. It comes to rest in the mind by way of conception and principles. It must be the object of intelligence. And, intelligence has to operate within any religion which has doctrine, such as Christianity. Because, Christianity is not only a cult, not only a moral system, and not only a spiritual system, but, it is also a body of doctrine. This comes from the historical record. This body of doctrine was not derived by experimentation, it was not derived by any of the testing devices used in psychology or sociology. It did not use any of the logical structures which are a part of the formal logical character of modern science. Basically, Christianity arose as a concrete witness to God, in Jesus Christ, and it is a religion by which people bear witness through miracles and personal commitment. The appeal is to the Man-God and to the Resurrection. This is the word of God. This has been the traditional position of Christianity, whether it be Catholic, Protestant, or Greek. This is a supernatural revelation. So, this kind of religion, which pretends to rest its unique claims upon a supernatural revelation, seems to be totally outside the realm of scientific method. This does not mean that within the totality of doctrine, which is evolved in this process from the original revelations of our Lord, that there does not proceed logical structures and reasonings. Christianity developed a theology and this is a rational system. I don't think it's a constructural system, and I don't think it's a scientific system. But, it is a rational system and you can make a formal rational analysis of

it, but methodologically and epistemologically it's a different kind of discipline than philosophy or science. Some things that have been called religions have not developed theologies. Christianity, at first, was a totality, then when Christian churches appeared, most of them developed theologies. We make a distinction in theologies between that aspect of religion which rests its claim for being different upon a supernatural revelation. This should be distinguished from a religious level within man that's independent of any kind of revelation. But, there is a natural approach to religion and I was partially talking about that this morning when I said that man in his encounter with reality does some of the kind of thinking that Father Clarke calls wholistic. I have talked about this as being as unsophisticated, natural interpretation and discovery within the individual of a wholeness in the world and of a presence of God. This gives rise to another type of religion, a natural type of religion which man develops. Intelligence acts within this type and there is reasoning, but, I think this type is also allied to philosophy rather than to science. This is not science. Backing up further, if you take primitive magic and call it religion, then, I think you're getting to something which is more analogous to science than to philosophy. Some investigators have claimed that this is a mixture, in a primitive embryonic sense, of some aspects of religion and science. I think that much of the reasoning that went on in primitive magic is much more like the scientific method than it is like religion. I'm giving specimen answers, and in order to give a full answer I'd have to consider different kinds of religions, some which I know nothing about. I know something about the ones which I have mentioned here.

FLOOR - I would like to ask the panel to discuss the influence of religion on civil law. How far do you think the organized Christian religion should go in trying to influence civil laws? I'm thinking about a particular case, that is the recent Supreme Court's ruling about the birth control law. I believe this was in Connecticut.

DR. NAGEL - The question is unclear. Is this a question of fact or what it ought to be? On the question of how far it has gone, there is the historical record, there has been a tremendous amount of influence. I don't suppose any of us would dispute that question. For example, in certain states there are laws which are clearly the expression of certain particular religious views and which are opposed by other religious groups. This is a matter of fact. If the question here is, how far should it go, then obviously I'm not talking for the panel, I'm just talking for myself. I strongly believe that questions of civil law should be determined on the basis of social policy and ethical

norms. Sometimes, on the grounds of expediency, this is not possible. In this case, best judgments as to what is desirable social policy must be provided, and this involves conceptions of morals. I believe that ethical judgments can stand on their own feet, they do not require support. I strongly disapprove of a continuance of any attempt to legislate, in civil courts matters that affect the lives of people who are disbelievers. This is done many times in the light of a creed of some particular religious denomination.

FATHER CLARKE - I think, in general, it's a very dangerous thing for organized religious groups to try and assert any kind of political or organized pressure for making laws. This certainly has been done in the past but it's not a good way of doing things. Because, many other considerations should enter in for passing laws. For example, there is no use passing a law, even though it may be a very good moral or religious thing, if the majority of the people for whom it was made simply don't believe in it. They won't support it. A law which has very little chance of being actively supported by the majority of public opinion is pretty much a waste of time. Hence, there are all kinds of considerations which would restrain one from trying to impose laws which just won't work, and which won't be accepted by the majority of the people. So, the judgment involves heavily the political and social norms in which the organized religion have no special competence. They are not equipped by their religious inspiration or revelation to handle these concrete pressures of policy. And so, they shouldn't assert any organized political pressure. They can present their general view and then the pressure, if any, should be put forward by the individual citizens who may be of that religious persuasion. The citizens should apply their own judgment, knowing the political situation in a given area with respect to a given law. So, I think it should be done through the individual, acting as a citizen, making his own judgment. Perhaps the religious group can provide inspiration but the group cannot claim any kind of authority to decide these special questions of legal policy.

DR. LEHMANN - A religious group consists of individuals. These individuals are members of society. A religious body, church, or any group such as this, that has a conviction, has a responsibility to put this out before society. They should argue for them, not from a privileged position, but from a point of view of a responsible citizen participating in society. You mentioned the case of the birth control law in Connecticut, which incidentally happened to come into being as a result of protestant group pressures. I would like to mention the question of civil rights.

Here is an area where religious bodies have some very strong convictions and, if they are silent on a question such as this, if they stay silent because they feel it's a minister's place, or it's a church's place, to keep people happy, then we are in trouble. If a church does not speak out and take a strong stand on something it regards as fundamental, then I think it's remiss. I reemphasize that the group should do so, not from a privileged position, but from a position of a responsible citizen.

PROFESSOR MARGENAU - I suggest, first of all, that every western religion has an ethical component. And, ethics infringes on the behavior of people. It should regulate the customs as well as the individual behavior of people. Civil laws are not made by religious bodies, but by political bodies. Therefore, it would seem to me that any religion, any religious creed with a spark of life in it, ought to make its ethical views known with respect to special problems that appear in society. It is within the discretion and judgment of legislative bodies to adjudicate the various claims of the religious groups.

FATHER HENLE - At this point there is not much left. I think a distinction should be made between (this is going to be misunderstood) the natural ethics within the religion which is based on revelation and the ecclesiastical component within the religion. I don't think any religious group should attempt to have any part of its religion enacted into law or favored by law. I don't think any group should do this. This is completely wrong. I don't think the Methodists should campaign for imposition of taxes to support Methodist ministers. And, Catholics should not campaign to have certain Sunday observances because that's their holy day. But, it's a quite different story when you move into the level of ethics, and I think this is what we are talking about in the question of civil rights. Questions like this demand a response from individuals and religious bodies. In ethical matters, our churches and our religions have not only a right, but an obligation to attempt to influence civil legislation and the development of our court procedures.

FLOOR - This is kind of personal Dr. Rabi, and you may choose not to answer it, but I should like to know when you first knew that a fission weapon, and I underline the word weapon, was possible? In addition to that, speaking as an Eastern European, and presumably Jewish background, will you relate to us some of the impressions that crossed your mind as you traveled towards Los Alamos, for the first time, knowing that the weapon would be built and presumably used.

DR. RABI - When did I know the weapon would be possible. It was only a few months before it functioned. As a matter of fact, a very short time before it functioned. I wasn't entirely sure until the very end. I mean there were still differences of opinion and I might say that people layed bets on the yield. There were many who bet zero, in fact, some very distinguished names. The second part of your question, about being an Eastern European, I'm sorry I can't enlighten you, I was there for only a few months before I came to New York and I have no proper recollection of the place, but I can give you names of people who would know.

FLOOR - Would you speak from a Jewish background? I wonder whether as you travelled towards Los Alamos was there a feeling of vengeance? The weapon was possible, and it was very likely to be used. Where was the logical place for its use? You certainly knew the historical circumstances in Europe, I'm speaking about the Jews.

DR. RABI - It's a very important question. There were many good reasons for developing the weapon and I never did try to sort them out. If you have five good reasons for doing something and each one is sufficient, you don't have to go very deeply into the subject. We were very much afraid that the German's were developing such a weapon, and so, we were afraid that it would get into wrong hands. We had quite a race about it. It turned out in the end that the race was more with ourselves, but there were other good reasons for developing it. Secondly, for a long time one didn't know whether it would work at all. So, in that sense, it was sheer scientific adventure. We went into a realm where we dealt with materials which had never been handled before. We had to use the furthest reaches of theoretical science and experimental ingenuity to discover the ground rules, the basic data on which we could begin such a thing. It was a time of very great excitement. It was concentrated work on the part of a large number of highly gifted people, it took brilliant invention. In that sense, one was part of a movement. Whether the idea of vengeance was very important in my mind I can't tell you, because, I haven't reflected on it. But, when I find out, I'll let you know.

FLOOR - After the talk by Professor Nagel a question arose from the audience - what is the meaning of life? I think the gentleman who asked the question was not satisfied with the answer, because, Professor Nagel said that the meaning of life was different for different individuals. I don't think it is. People in human history have sought an answer to this question. I would ask the panel to answer, in a broader sense, this question - what is the

meaning of life? This is a very important question because without life there is no science, philosophy, or religion.

DR. NAGEL - I'm sure others will want to comment on this, but, let me make myself clear. The question is obviously ambiguous. Often, the thought behind the question is that someone wants a meaning in life. You might feel that there is some kind of cosmic purpose, or cosmic structure which is related to human effort. Now, let me put that question hypothetically. Suppose you had conclusive grounds to believe that the universe would be destroyed in X years. Suppose this was something that was beyond question. And, everybody who thought about the question, and studied it, agreed that the universe was going to be destroyed. Would it still be significant to ask what is the meaning of life? I would say in a certain sense yes, because this would mean that, I as a human being, will not be fulfilled. But, you see that this answer would then be given in terms of an underlying structure. But, I like to think that I would behave the same way even if I knew that my life was going to terminate tomorrow or next year, and that I would continue fulfilling certain objectives because they are an expression of what I regard as valuable. Now, its in this sense that I say, different people and different cultures have different purposes. Professor Rabi emphasized the meaning of life as satisfied curiosity about the universe. I confess that I share that predilection. I'm curious too, and I suppose this is in everybody. I have the feeling that I ought to know what's going on. But there are a lot of people who don't have this drive, and whose life might be devoted to artistic achievement. This is a very legitimate purpose. What is fatal to any kind of decent human life is having no purpose at all, just drifting and being buffeted by every desire that comes along. And, I say the task of reflective ethics, reflective society, or philosophy, is to indicate the goals that human beings ought to select for themselves and try to achieve. Why? Because, it somehow enhances the human scene. It is something that makes us feel that we are really dignified individuals.

DR. RABI - I think this is one of the basic questions of today and it has become more serious with an advancing technological organization. For example, right now in New York there are men setting type for newspapers; it is proofread and then it is destroyed. The right to do this is jealously guarded. Now, in this case, one has to ask - what is the meaning of life? But to most of us this work is devoid of meaning, its counter-constructive, to coin a word. He's doing it because we have not faced a situation which is obviously coming to be more and more important. That is, we are stuck with all sorts of labor saving devices, automation, computers, and so on. The form of

life, the purpose of life will be altered as leisure increases. This is a question that we will face. And, this is not the purpose of life as a whole, I'm not interested in that. But this is the purpose of this one man, and that man's life is important. What should one do to make life useful and significant? To have meaning, one has to act and one has to do. This is a problem that we have to face. You know my own solution. We have a tremendous, endless frontier of basic endeavor, which must be respected by everybody, and which, when properly guarded, can do an immense amount of good. We can use our resources in this and make life significant. But, we must begin to understand this, we must get an education which fits us for the world which is upon us. There is bound to be a great deal of unrest. People try to find meaning, and they try to find a place for themselves in an active world. This is one of the great problems which will face our legislatures, churches, organized religion, and every kind of thinker in the time to come. It's not too early to start because the next generation, as we all know, is facing it right now. Now, will you say shall I arrest development or call a halt to science and technology? We can't, even if we wanted to. We are bound to go at an accelerated pace in a certain direction because this is something which has gone along almost completely unplanned. That question was a very good one and I'm sorry I can't give any real answer to it.

FATHER CLARKE - I certainly feel irresponsible in not taking up that question. I would say, in terms of a series of intelligent decisions and options, that I could arrive at the overall purpose of life. If I make a reasonable option, let's say that I accept the source of all reality and myself to be a personal God, then I can go further and accept a further option about the message of Jesus Christ. This sets up the meaning of life in this very general way. It is to respond to a vocation, or a call of God. It means that we grow, in this life, in the image of God and that we are constantly growing in the image of God. In accordance with this development, one looks forward to an eternal union with God. The purpose of this life here is dynamic, it's one of growing constantly into an image of God in response to his invitation and his call. I would mean a full self-development, both knowing the world as fully as possible, and then loving it and the people in it as fully as possible. This general notion of growing into the image of God would be the purpose of life, I would say.

FLOOR - I would like to ask a question of Father Henle and Father Clarke which is a follow-on to the previous question. Religion attempts to answer questions about the universe, ethical questions, and questions about the meaning of life.

But, the religious answers are based on faith. Faith, to me, is a unique individual thing. If faith is unique to the individual, how can religion supply a universal answer? If the answer to this is that religion is based on facts or revelations, then religion tends towards science and must use the scientific method - would you comment on this?

FATHER HENLE - We have an ambiguity in the meaning of the word faith. This has haunted us all day. When we talk about religious faith (as it is used in Christianity or more specifically in Catholic theology) this is neither an individual experience, nor a thing solely individual, nor is it a thing solely external. Faith is regarded, in this tradition, as being an acceptance of our Lord and an acceptance of an objective teaching of himself and his church. He didn't say that everybody would have faith and that this would internally be fixed up in some way. He did indicate there was to be preaching, and that the word was to be carried to everybody. This word was doctrine. This was meant to be uniform so that there would be no contradiction between a universal and objective kind of religious doctrine. If you make the faith a unique subjective individual event, then I think that is incompatible with Christianity. Now, I know that there are forms of protestantism which do make it like the one you've described, but, this is not what I would accept as faith.

FLOOR - If faith is not based on fact, how can it be other than an individual feeling?

FATHER HENLE - It is based only to a certain extent on fact. Without the historical fact of Jesus Christ we wouldn't have any Christianity.

FLOOR - If it is based on fact, why can't religion employ the scientific method?

FATHER HENLE - To come back to what I said yesterday, the difference between science and other disciplines is not that science is based on fact and other disciplines are not. The position which I have been taking these two days is a position which says, there is a world of fact and out of this grows all the disciplines. The artist deals with facts too. The physicist deals with facts, the theologian deals with facts. I do not accept this - that it deals with facts - as being the mark of science. Philosophy deals with facts. If you don't deal with facts, you're not dealing with anything. You've got to have contact with reality. But, the following is the position which I've taken, and I've differentiated myself from at least

two and perhaps two and one-half, of my colleagues. It is that there are many different ways of dealing with the facts. The word fact itself is ambiguous because you can deal with it in many different ways. The word fact itself, as it's given in reality, is extremely rich. If you're interested only in the acceleration of falling bodies, it's immaterial to you that the falling body is a stone that's slipped off of a cliff, or that it's an apple that's fallen off of a tree, or that it's a flaming engine falling off a plane, or if it's the heroine, if she's been tossed over the cliff by a villain. From the standpoint of the acceleration of bodies and from the standpoint of physics, these are all facts, but, they're approached quite differently if you're going to talk about ethics of the matter. There's no ethics involved in the apple falling off the tree, but, there's certainly ethics in the thought of the heroine coming over the cliff. So, the position which I have been maintaining, of course without establishing it since it would take me a very long time, even if I could do it, is that you cannot precisely differentiate science and the other disciplines. A religion which is not based on facts, in my mind, would be worthless.

FLOOR - Are you saying that religion is based on fact, but, that there can be many interpretations of fact?

FATHER HENLE - Now, let me discuss the word interpretation. I remember somebody telling me, when I talked to him about the question of interpreting the Bible; you don't want to interpret the Bible. I said, why not? He said, because interpretation means making a thing say what you want it to say. So, interpretation is a bad word. Let us say that we come at the facts from different kinds of methodological stances and for different purposes. Therefore, the fact is much richer than what we do with it in any one context of a particular discipline. We find more in it and we work more out of it. Now, if you want to call that an interpretation, that's all right. Interpretation is a word which I'm afraid of.

FLOOR - Isn't that still an individual phenomena?

FATHER HENLE - Well, it's not individual in the sense that a physicist can come and measure it. He's an individual and he's measuring an individual piece of fact. The artist looks at it and he's looking at an individual piece of fact. He's an individual but, these can be universalized.

FATHER CLARKE - If I make one brief comment, I can help you a little bit. The act of faith must be a unique event, because it's a personal decision. But, many different people can make their own personal decision towards a common goal, and therefore, join in the faith. I don't think that's a false statement. It's a personal act, and therefore, it can't be shared. I would say that the personal decision must be made by you and not by a community or anything like it. But, if it's toward a common center, you can find many people making the same decision. But, the kind of response required is quite different than that toward the scientific fact. For example, if someone asks - do you love me? Or, do you trust me enough that you will accept my word? The answer is given after you have sized him up, with all the equipment the mature person has. After this, you might say yes, this is the kind of person I would trust. That's a personal fact and, it's based on the presentation of a person to you. It can only be solved by the whole, mature response of yourself. This is quite different from sizing up an experiment in a laboratory. So, it's a unique personal event towards a common center. Christ appeals to many people and the experience can be both unique and shared.

DR. LEHMANN - I want to comment that there is a large amount of individuality in this. Dr. Rabi pointed to the printers, I'd like to cite the guy who spends his life tightening nuts on the differential in a Chevrolet production line. You must realize that the people in this room are an elite in education and in thinking. Many people, throughout this world, do not think in the kind of terms we're using today. And yet, these people have a purpose in life. To insist that the purpose in life for Dr. Rabi should be the same as the purpose in life for me, is carrying it a little too far. There is a great measure of individual determination, coming to terms with yourself, and your maker, as to what your purpose in life is. If different people have a common belief, then they tend to get together in a denomination, or a religion, and they sit together. The last thing I want to say is, I find it a little repugnant for me to say what the purpose of life ought to be for you.

FLOOR - I am confused and concerned that we have equated religion with Christianity. I am not against Christianity, don't misunderstand me, but, I know that there are millions of people who do not subscribe to Christianity. How do we reach those people with an ethic that will help them realize the situation the world is in and what they can do about it?

DR. SARKAR - In response to this question, I have just a few things to say. I appreciate the fact that there are other religions. To my mind, religious consciousness is based in every man, it is not to be grouped into certain forms of religion; because, we define religion as that creature which gives us a basis for living. Religion is that which gives us the foundation for life itself, and it helps us realize the purpose that is in life. In the Indian religion we have distinguished at least four purposes. The first is that, whatever the purpose is, it should have a model basis. I'm using model in a very wide sense. For instance, respect for mankind in general, without this no one can live. You must allow others to live, and in the way others would like to live. That is the foundation of life. Then there is the second purpose, every individual should have some money to live with. Without money you can't live. So that there should be avenues open for individuals to earn a living. The third possibility is that every individual has certain passions and repensities that must be satisfied. Satisfied, of course, in a normal human way. These must be understood, not so much technically, but just normally and with common sense. We must admit the experience that a scientist has and that which a man of other religion has. People have different customs. We should realize that on the purposes of life one has to remain silent, one should not discuss further the fundamentals because everyone has to be respected. I think that every individual is an ordinary person. He may be a scientist, and be well known in his domain, but in other fields just an ordinary man. In other fields, he has to depend on other individuals and experts. Now, similarly in religious matters, whether it be high or low, there are many ordinary persons. We must recognize that there is a difference in the knowledge of the individuals in each religion. Now, when I generalize the whole experience, I would say that any individual, who may be an expert in one aspect of learning or experience, should consider himself just an ordinary person in others and he should respect all other persons from that position. Our final objective is universal tolerance. This means the welfare of mankind as a whole, and for the individual as much as is possible.

FLOOR - I should like to address this question to Dr. Sarkar and his common sense approach. I hope we can get off the epistemological level for a moment and look at a general level of the theory of ethics. I would like to ask you, from your background, whether you see any substantial moral distinction between the question of mass destruction versus an individual life? This question was originally asked in terms of Christianity.

We got a general answer, we also got a rather strong assertion that there is no substantial difference. From your background, what would you say on this matter?

DR. SARKAR - You mean mass destruction versus the destruction of the individual? I will approach the point from a different way. I think that individual has a value, and that individual is a factor. So, the individual should be respected by all men. I would think that they have also certain purposes. Now, that also has to be respected. An individual can only live when there is a society to live in, or live with. I will not separate the individual from the society and I will not prescribe any action which will be against all men. It would be against the individual as well. So, mass destruction cannot be condoned. I think the two should live together; because, one without the other is absurd.

FLOOR - I would like to ask Dr. Sarkar a question. This is a broad, double-edged question and any comments would be appreciated. The orient has its own religion and this has developed independently of western thought. However, science as we generally think of it, is developed in the west. What influence, if any, has science had on religion in India, or the orient in general, or vice versa?

DR. SARKAR - The question is a good one. I feel that in India science has developed from the very early centuries. Almost all countries have been influenced by Indian scientific notions. We know that the sciences of mathematics, astronomy, physics, chemistry, and even medicine, developed in India and was transmitted to all the countries, beginning with Persia and Egypt. So, there is a long tradition of science in India. In India, we do not separate science from the experience. We may distinguish different aspects of experience, but we will say that experience basically is experience. It cannot be divided into parts or compartmentalized. So, if there is a scientific development, we welcome it since the religious experience will never contradict it. We have always accepted these scientific developments, and the religious consciousness will proceed along with the scientific developments in any aspect; because, we share experience from all sides. We do not partition experience. If chemistry develops we will welcome its results. And, if medicine develops we will welcome its results. So, it is a question of participation because experience is one, though it may have many sides. So, if you develop from many sides, there is a development in the core of experience. So, we enjoy that core, without dividing or partitioning it. That is our point in the understanding of science versus religion.

FLOOR - I was very happy to see this question raised and directed toward the person who might influence us in thinking about the oriental side of the world. This is a question I asked last year, as some of you may recall, and which was not answered. Is there anything in the ethics of oriental religion, particularly your own, that would be in conflict with the overweening concept of Christianity that you have listened to the last two days? I thoroughly agree with the lady who said that, we Christians speak as a minority. Do you find that what we do, in trying to be big brothers of the world, is actually in conflict with an oriental ethic? And I might add one more thing, I think next year we ought to have a historian on the panel.

DR. SARKAR - I will answer this question in a somewhat complicated way, but, you should understand. Our religion or ethical consciousness, I can tell you straight away, is not necessarily concerned with God. I believe in God. We may or may not believe in God, but we are still religious. And, we are modern because religious and modern consciousness lies with the individual. It lies within the individual's understanding. Most of the religions of India do not believe in God, but still they are proud religions. All have some kind of ethics. Religion or ethics we consider as a way of life and there must be options according to different impediments and capacities of people. We allow people to develop their life in the way they choose. There should be freedom in living. So it matters little if you do not believe in God. You can be perfectly religious. Some religions are openly materialistic, but, even they have the consciousness for doing good. So, they are taken as people who have ethics, because they allow others to live comfortably. So, at that level, they are quite good people, even though they do not believe in any God. Now, in the case of the Buddhist, they do not believe in God, but they believe in perfecting the individual, and following a right way of life. They have a view of correct knowledge, faith and conduct. By faith I don't mean faith in something, I mean faith in general. Conduct means a very broad way of life. We should not steal, we should not kill, these are broad ways of life. Here I wish to say a few words to Dr. Nagel. We can all agree in the fundamentals, if we follow the broad ways. Buddhism can be modified in the course of discussion. It depends upon what suits a particular society. This happens in science, philosophy and religion. So, it is a matter of discussion. But, four or five rules are quite sufficient for the living process, so if we do not attach one sentiment to others, we can live together very happily. In most of the religions we prescribe these. Let me speak about the ultimate view of God.

The view of God can be variant. This is true even in the Christian religion. The interpretations are different and this comes from the experience inside of the individual. So, differences are admitted in the view of God. Now one may believe in one God or many Gods. We allow beliefs like this; because, what is fundamental is the understanding of some kind of process of might. Some people will believe in God and some people will not. But, these people might still be deeply religious. It is possible. The Indian philosophical systems developed before the Christian era and after the Christian era we have been clarifying our positions in terms of new experiences. So, India, illustrates the point that without God, people can be religious.

FLOOR - I would like to raise a question about this distinction between scientific and religious questions. I think we've arrived at a point where we are saying that the difference is really a matter of methodology. From a meaning and content point of view, will this distinction stand up under very close scrutiny? Surely a value system is derivative from a world view and in much the same way a scientific world view will give rise to certain conclusions about one's place in the universe. As we pursue scientific questions further into the C field we arrive at a kind, or quality, of question which in an operational sense becomes more difficult to distinguish from religious questions. I think this is a little bit akin to some of the remarks of Dr. Nagel. Would any of you people care to make a comment on this point?

FATHER CLARK - I think there is still a very fundamental, unbridgeable gap between them; because, as long as one stays within what is recognizably called science today, the kind of concepts one develops over in the C field are always tied to a type of testing and particular experimentation. Now, it doesn't matter how far you go, it's always aimed at a hypothesis from which these particular observable things follow. Religion doesn't operate that way. From a religious hypothesis, about the meaning of the universe, you can't make any particular prediction. You can't deduce that this will happen if I do this in the experiment, because, religion is concerned with the total meaning and this can't be put into any particular experiment. The general structure is somewhat similar but science today demands verification and testing. So, the link between the hypothesis and the kind of testing is always irreducibly different. You simply cannot test, in the same way, any particular religious predictions. In fact, I don't think philosophy can predict anything forwards or backwards either.

But, religion can predict the future, if you believe it. It's not a particular thing that can be tested in some observable way out in the public laboratory. And, that's the gap that can't be crossed.

DR. MARGENAU - I appreciate the depth and the acuteness of the question. I am perhaps somewhat responsible for your question in having called attention to the fact that science and religion have a great deal in common. In fact, in terms of a very neutral sort of methodology, one can describe both in almost identical terms. I would maintain this parallel. But, let me say this, both of these disciplines have cognitive elements. Ethics which endeavors to control human actions, to tell us what we ought to do, is in one sense quite different from both the cognitive and the devotional aspects of religion and science. The difference lies in the following. It is the business of science to understand, and if possible predict, although prediction is usually the consequence of one's ability to understand. One concerns oneself with facts, and the language of science is therefore the indicative. The voice of ethics, on the other hand, is fundamentally the imperative voice. The fundamental propositions of ethics say - thou shalt. The fundamental propositions of science speak in terms of what is, what exists, and what ought to be assumed in order to satisfactorily explain. This is more than a linguistic difference. I believe it is impossible to get the 'ought' of ethics out of the 'is' of science. Once you have the ought of ethics in a postulational way, and the is of science in a postulational way, everything else proceeds according to the form of reason. But, it is my belief that the two are not conjoining. The is and the ought are quite distinct. You may say science tells us how to live, you may say science tells us how to preserve human life, because everybody wants to continue to live and enjoy life, well, that simply isn't true. There are people who prefer to die. On the other hand if somebody says, you ought to continue to live, you can answer, where is the ethical mandate for that, where is the ethical reason? It may be ethically right for the human race to perish. That is to say, science enables you to preserve life if your ethical conscience, your ethical beliefs, require you to preserve life. Science equally enables you to kill, but, it doesn't tell you whether it is right or wrong to kill. Science does not have the counterpart. Now, I've sketched the contrast in rather extreme fashion, and I would acknowledge that it isn't quite as bad as it seems. But, time is so short that I wanted to express this by speaking to you in terms of extremes. If you acknowledge the fundamental difference, ethics says thou shalt, and science which says it is, so then beyond that the formalism in each discipline can be represented to be very much the same.

PROFESSOR NAGEL - My remark was not intended to be an answer to the question. I really wanted to raise a similar question. I was hoping that the members of the panel would then contribute answers. One of the points which has been stressed throughout our discussions is that you need a distinction type of thought, or a different epistemology, to carry on an investigation which is concerned with global questions. Questions like, why is there a world rather than nothing at all? It is very easy to think, when you ask questions like this, that you are asking a genuine question; because, the form of the question is like many other questions that seem very significant, like, why is it that X blundered in reading a highway sign? That could be answered perhaps in terms of his being inattentive, or his vision not being adequate, and so on. Then you can raise a more general question - why is it that people who drink before they drive commit errors in reading signs? You can answer that more general question. You can include the generality but, if you begin to ask well how is error, in general, possible, it becomes very difficult to know whether the question has any content at all. Now, let me just make the point in terms of an illustration. There are a lot of things about the world that puzzle us, and we could ask questions about them. For example, why is there a solar system? We don't know any reliable answer to that but we have reasonably plausible guesses. One can raise a more general question about space. Of course, space is three dimensional. Why does space have three dimensions? Now, can this question be answered? Well, suggestions have been made for an answer. For example, a very great Dutch physicist showed that, under certain conditions, you wouldn't have a stable solar system except when you have a three-dimensional space. In all of the answers to very broad questions, you always are taking something for granted in the terms with which you give an explanation. So we might be able to explain why space has three dimensions, or why space is finite or infinite, whatever the case might be. But, when you begin to ask, why is there a world rather than nothing? - It's hard to know what kind of an answer would be satisfactory. If you give the answer in terms of some initial creation, this is obviously postponing the evil day. Similarly, if you give an answer in terms of the prevalence of a divinity, you are avoiding the problem. Unless, of course, you say, or know, that God exists. Here you are dealing with a question that is not answerable in terms of science; because, you are trying to show that some things are necessarily so. Now, how can you show that it is necessarily so? Well, I don't know of any other way of showing something to be necessarily so, except by dialectic. Namely, by the kind of reasoning that you use in mathematics when you show, for example, that it is impossible for the ratio

of two integers to be equal to the square root of two. That is, you show that the counter assumption is self-contradictory. But, you see this would never decide anything as to what actually exists. It only shows something about the consistency of ideas.

My parting remark is, I agree entirely with Professor Margenau that you cannot leave the ought out of ethics. In this sense, science is incompetent to deal with ethics. Science is incompetent here because it doesn't ask these questions, it isn't dealing within this particular domain. Namely, when you are dealing with what ought to be, you are asking what are the ideals that human beings should pursue. This is a different domain from the one in which most of science operates. But, knowing this, if you say this is the issue that I want to be concerned with, then we can move on. This seems to me to be amenable to the same kind of inquiry, and one can ask the so-called factual questions. I agree that you cannot deduce the 'ought' from the 'is', and what is normative is not descriptive. But, the norm is not something that is entirely arbitrary and it depends upon what the character of the existential thing is. And, so, while on the one hand, and this is the typical philosophical ailment, I would agree, on the other hand I would say yes...but.

MAJOR DUNN - Thank you very much. I would like to thank the panel for their very honest and earnest contributions, and for their forebearance. They certainly made my job very easy. In a one sentence summary, we've seen that there is no simple solution to the idea of personal commitment, and we've heard discussions of methods, techniques, and goals which varied broadly, but, I think the panel agrees that a personal commitment of some sort is required.

CONCLUSION

COLONEL GILBERT - I just want to thank the panel members for being with us; I also want to thank the audience for their participation and particularly I want to thank the group of officers and civilians in the Laboratory who did all the work to make this possible. It has been very nice.